N00204.PF.004055
NAS PENSACOLA
5090.3b

FIVE YEAR REVIEW OPERABLE UNITS 1, 2, 3, 4, 11, 13 AND 18 (PUBLIC DOCUMENT)
NAS PENSACOLA FL
7/18/2012
TETRA TECH

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Naval Air Station Pensacola		
EPA ID: *FL6 170 024 412*		
Region: 4	**State:** FL	**City/County:** Pensacola/Duval

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the Multiple sites achieved construction completion?** No

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** Department of the Navy, Naval Facilities Engineering Command Southeast
Author name (Federal or State Project Manager): Patty Marajh-Whittemore.
Author affiliation: Naval Facilities Engineering Command Southeast
Review period: 2008 - 2013
Date of site inspection: May 2-4, 2012
Type of review: Statutory
Review number: 3
Triggering action date: March 12, 1998
Due date *(five years after triggering action date)*: August 22, 2013

Five-Year Review Summary Form (continued)

The table below is for the purpose of the summary form and associated data entry and does not replace the two tables required in Section VIII and IX by the FYR guidance. Instead, data entry in this section should match information in Section VII and IX of the FYR report.

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU3, OU13

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU1	**Issue Category: Monitoring**			
	Issue: The Explanation of Significant Differences (ESD), which includes a revised surface water monitoring program to ensure protectiveness of surface water, is currently in regulatory review. The new monitoring program has been implemented, but is awaiting formal regulatory approval.			
	Recommendation: Continue surface water monitoring in accordance with the draft ESD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	USEPA/State	USEPA/State	Enter date.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU2	**Issue Category: Remedy Performance**			
	Issue: Remedy has not been fully implemented.			
	Recommendation: A Record of Decision (ROD) Amendment is necessary to address the change in remedy at Site 11 and excavation of radiological contaminated soils at Sites 12, 27, and 30.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Principal Responsible Party (PRP)	USEPA/State	Enter date.

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU4	**Issue Category: Monitoring**			
	Issue: Monitoring wells 15GGR1 and 15MW76 are no longer present. Maximum Contaminant Level (MCL) for arsenic has changed from 50 micrograms per liter µg/L to 10 µg/L.			
	Recommendation: In accordance with the requirements of the long-term monitoring (LTM) plan, monitoring wells 15GGR01 and 15MW76 need to be replaced. An ESD is necessary to address the change in the arsenic MCL.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	PRP	USEPA/State	Enter date.

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU11	**Issue Category: Monitoring**			
	Issue: Monitored Natural Attenuation (MNA) has not yet been initiated.			
	Recommendation: Implement the groundwater natural attenuation monitoring.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	USEPA/State	Enter date.

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU18	**Issue Category: Monitoring**			
	Issue: Remedial Action Work Plan must be completed and approved prior to remedy implementation.			
	Recommendation: Await approval of the Remedial Action Work Plan.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	USEPA/State	Enter date.

To add additional issues/recommendations here, copy and paste the above table as many times as necessary to document all issues/recommendations identified in the FYR report.

Protectiveness Statement(s)
Include each individual OU protectiveness determination and statement. If you need to add more protectiveness determinations and statements for additional OUs, copy and paste the table below as many times as necessary to complete for each OU evaluated in the FYR report.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU1	Will be Protective	Click here to enter date.
Protectiveness Statement: The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through natural attenuation. The remedy is protective in the short term as institutional controls are currently being implemented. The surface water monitoring program is being implemented as part of LTM, as described in the draft ESD, allows for protectiveness of the remedy.		

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU2	Will be Protective	Click here to enter date.
Protectiveness Statement: The remedy is expected to be protective of human health and the environment upon installation of a soil cover at Site 11; completion of excavation and off-site disposal of contaminated soil at Sites 12, 27, and 30; and implementation of groundwater monitoring at all sites. Land use controls (LUCs) have been implemented at all sites and will limit exposure to contaminated soils and groundwater at Sites 11, 12, 27, and 30. The remedy is protective for the short term as LUCs continue to be implemented.		

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU3	Protective	Click here to enter date.
Protectiveness Statement: The remedy for OU3 is protective of human health and the environment.		

Operable Unit: OU4	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: This remedy is protective. Concentrations of contaminants of concern (COCs) are decreasing over time. Exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to, or the ingestion of contaminated groundwater.		

Operable Unit: OU11	*Protectiveness Determination:* Will be Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals through natural attenuation. The remedy is protective in the short term as institutional controls are currently being implemented.		

Operable Unit: OU13	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The selected remedy for OU13 is protective of human health and the environment.		

Operable Unit: OU18	*Protectiveness Determination:* Will be Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy is expected to be protective of human health and the environment upon excavation and off-site disposal of the most contaminated soil, implementation of groundwater monitoring, and implementation of LUCs to limit exposure to remaining contaminated soils and groundwater. The remedy is protective in the short term as LUCs are currently being implemented and signs are posted restricting access to the site.		

Sitewide Protectiveness Statement (if applicable)	
For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.	
Protectiveness Determination: Choose an item.	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: Click here to enter text.	

NAVFAC
Naval Facilities Engineering Command
NAVFAC SOUTHEAST

This document, *Five-Year Review, Operable Units 1, 2, 3, 4, 11, 13, and 18, Naval Air Station Pensacola, Florida*, has been prepared under the direction of a Florida Registered Professional Geologist. The work and professional opinions rendered in this report were developed in accordance with commonly accepted procedures consistent with applicable standards of practice and based on information by others. Should information come to light other than what was known at the time of this document preparation, the undersigned geologist reserves the right to modify his findings. This document was prepared for Naval Air Station Pensacola, Florida and should not be construed to apply to any other site.

DATE
Gerald Walker, P.G.
Florida License No. PG-1180

This page intentionally left blank.

TABLE OF CONTENTS

APPENDICES

TABLES

NUMBER **PAGE**

FIGURES

NUMBER **PAGE**

ACRONYMS

ACM	Asbestos Containing Material
Aerostar	Aerostar Environmental Services, Inc.
ARAR	Applicable or Relevant and Appropriate Requirement
BEI	Bechtel Environmental, Inc.
BEQ	Benzo(a)pyrene equivalent
bls	Below Land Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
cPAH	Chlorinated Polynuclear Aromatic Hydrocarbon
CSF	Cancer Slope Factor
CTL	Cleanup Target Level
CTO	Contract Task Order
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
ECOPC	Ecological Contaminant of Potential Concern
E&E	Ecology and Environment, Inc.
ESD	Explanation of Significant Differences
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FFA	Federal Facilities Agreement
FS	Feasibility Study
GCTL	Groundwater Cleanup Target Level
GSI	Groundwater/Surface Water Interface
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HI	Hazard Index
HSWA	Hazardous and Solid Waste Amendments of 1984
IAS	Initial Assessment Study
ILCR	Incremental Lifetime Cancer Risk

ACRONYMS (Continued)

IR	Installation Restoration
IRA	Interim Remedial Action
IWTP	Industrial Wastewater Treatment Plan
LDR	Land Disposal Restriction
LTGMP	Long-term Groundwater Monitoring Plan
LTM	Long-term Monitoring
LUC	Land Use Control
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
LUCRD	Land Use Control Remedial Design
LURA	Land Use Restriction Agreement
µg/L	Micrograms per Liter
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MNA	Monitored Natural Attenuation
MOA	Memorandum of Agreement
MSWCTL	Marine Surface Water Cleanup Target Level
mV	Millivolt
NADEP	Naval Aviation Depot
NAS	Naval Air Station
NAVFAC SE	Naval Facilities Engineering Command Southeast
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NFESC	Naval Facilities Engineering Service Center
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NTTC	Naval Technical Training Center
O&M	Operation and Maintenance
ORP	Oxidation Reduction Potential
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
POC	Point of Compliance

PPE	Personal Protective Equipment

ACRONYMS (Continued)

PSC	Potential Source of Contamination
PWC	Public Works Center
RAD	Radiological
RAO	Remedial Action Objective
RASO	Radiological Affairs Support Office
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SCTL	Soil Cleanup Target Level
SVOC	Semivolatile Organic Compound
SWCTL	Surface Water Cleanup Target Level
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
Tetra Tech	Tetra Tech, Inc.
UCL	Upper Confidence Limit
UE	Unrestricted Exposure
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UU	Unlimited Use
VA	Veterans Administration
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has been contracted by the Department of the Navy, Naval Facilities Engineering Command Southeast (NAVFAC SE) to perform a Five-Year Review for Naval Air Station (NAS) Pensacola located in Pensacola, Florida. The Five-Year Review includes seven Operable Units (OUs) at the facility.

The purpose of this Five-Year Review is to determine whether the remedies at the seven OUs are protective of human health and the environment. The methods, findings, and conclusions of the Five-Year Review are documented in this report. In addition, this report identifies issues found during the Five-Year Review, if any, and presents recommendations to address them.

1.1 FIVE-YEAR REVIEW PROCESS

This Five-Year Review was prepared pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The United States Environmental Protection Agency (USEPA) is responsible for implementing statutory Five-Year Reviews. CERCLA § 121 states:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environments are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

This requirement is further interpreted in the NCP; 40 Code of Federal Regulations (CFR) § 300.430(f)(4)(ii) states:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."*

For federal facility sites under the jurisdiction, custody, or control of the Department of Defense, Executive Order 12580 relieves the USEPA of this responsibility and delegates the responsibility to the Department of Defense. The Navy is the lead agency responsible for this Five-Year Review at NAS Pensacola, working with the USEPA and the Florida Department of Environmental Protection (FDEP) through the Federal Facility Agreement (FFA) signed October 23, 1990.

1.1.1 Administrative Components

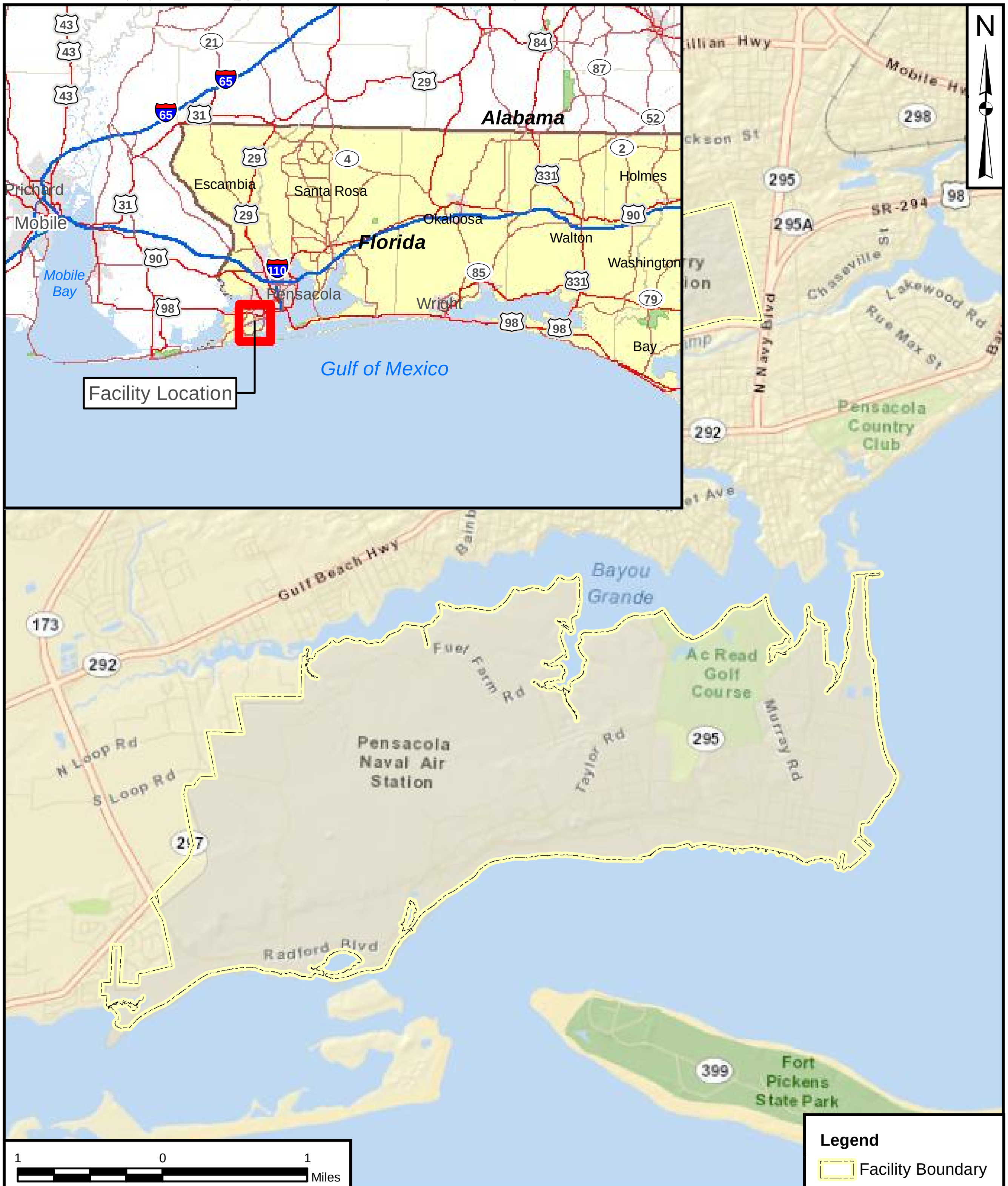
This is the third Five-Year Review for NAS Pensacola. The first Five-Year Review was conducted because hazardous substances, pollutants, and contaminants from past storage, handling, and disposal practices at OU1 and OU10 remained at concentrations above levels that allow for unlimited use (UU) and unrestricted exposure (UE) at NAS Pensacola. The first Five-Year Review only addressed OU1 and OU10 and was prepared in February 2003. Although the OU4 ROD was signed on November 30, 1999, OU4 was not included in the first Five-Year Review because, at the time the Five-Year Review was being completed the OU4 Remedial Action consisting of soil removal and groundwater monitoring had just begun and there was no current data detailing the site conditions.

The second Five-Year Review addressed OU1, OU4, OU11, and OU13 and was completed and signed on August 22, 2008. OU10 was not included in the second Five-Year Review because the site was transferred to the RCRA Program.

This Five-Year Review consisted of a review of the previous Five-Year Review; evaluation of the issues raised in the previous review, actions taken, and results; site inspections; personnel interviews; and a technical assessment of each site and the remedial actions underway. This Five-Year Review addresses OUs 1 through 4, OU11, OU13, and OU18, all of which now have signed RODs in place. This Five-Year Review is being conducted because hazardous substances, pollutants, and contaminants from past storage, handling, and disposal practices remain at levels that do not allow for UU and UE at these specific sites.

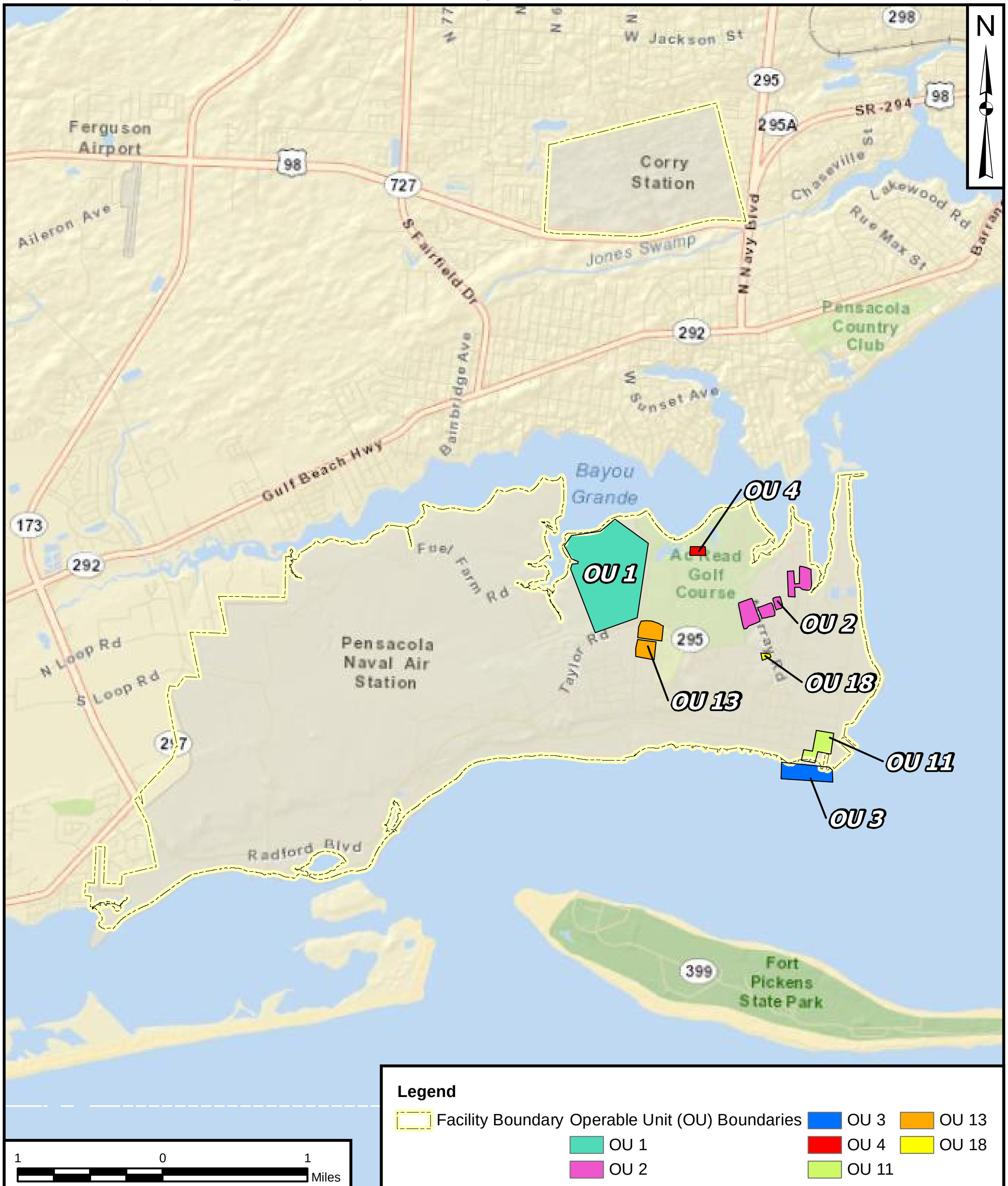
Sections 2.0 through 8.0 of this report are the Five-Year Reviews for OUs 1 through 4, OU11, OU13, and OU18, respectively. Each section includes the site's chronology; background and summary of the remedial actions performed; and the Five-Year Review findings, assessment, deficiency list, recommendations, and protectiveness statements. Section 9.0 provides a general summary, conclusions, and protectiveness statement for the OUs reviewed at NAS Pensacola. Figure 1-1 shows the location of NAS Pensacola, and Figure 1-2 shows the location of the OUs included in the Five-Year Review.

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewLocation.mxd [alex.montalvo 6/5/2012]



DRAWN BY GIS	DATE 6/5/2012		FACILITY LOCATION MAP	CONTRACT NUMBER 112G00702	CTO NUMBER 067
CHECKED BY A.I.	DATE 6/5/2012		5 YEAR REVIEW	APPROVED BY ___	DATE ___
REVISED BY	DATE		NAS PENSACOLA	APPROVED BY ___	DATE ___
SCALE AS NOTED			PENSACOLA, FLORIDA	FIGURE NO. 1 - 1	REV 0

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU.mxd [alex.montalvo 6/5/2012]



DRAWN BY GIS	DATE 6/5/2012	NAVFAC	OU LOCATION MAP 5 YEAR REVIEW NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NUMBER 112G00702	CTO NUMBER 067
CHECKED BY A.I.	DATE 6/5/2012			APPROVED BY	DATE
REVISED BY	DATE			APPROVED BY	DATE
SCALE AS NOTED				FIGURE NO. 1 - 2	REV 0

Tetra Tech conducted this Five-Year Review in conjunction with the NAS Pensacola Partnering Team, which consists of the following personnel:

- Patty Marajh-Whittemore, NAVFAC SE
- Greg Campbell, NAS Pensacola Public Works Department
- Tim Woolheater, USEPA
- David Grabka, FDEP
- Brian Caldwell, Tetra Tech
- Gerald Walker, Tetra Tech
- Sam Naik, CH2M HILL

1.1.2 Community Involvement

A public notice of announcing the initiation of this Five-Year Review was published in the Pensacola News Journal on (date). At the conclusion of the review, a fact sheet is planned for production and distribution to the Restoration Advisory Board and any other interested persons or organizations.

1.2 OVERVIEW OF NAS PENSACOLA

The official mission of NAS Pensacola is to provide facilities, service, and support for the operation and maintenance of naval weapons and aircraft to operating forces of the Navy as designated by the Chief of Naval Operations. Some of the tasks required to accomplish this mission include operation of fuel storage facilities, performance of aircraft maintenance, maintenance and operation of engine repair facilities and test cells for aircraft engines, and support of weapon systems. The following sections provide a history and chronology, as well as a brief description of the physical and geological conditions at NAS Pensacola.

1.2.1 History and Site Chronology

The U.S. Navy has maintained a presence in the Pensacola area since 1825, when a Navy Yard was established on Pensacola Bay. Between 1828 and 1835, the Navy acquired approximately 2,300 acres as operations expanded. Several natural disasters in the early 1900s destroyed the yard and forced it into maintenance status in 1911. Three years later the Navy's first permanent air station was established on the site of the old Navy yard. The air station has been the primary training base for naval aviators since that time and continues to expand (EnSafe, 1996a).

The Navy initiated an environmental investigation of NAS Pensacola in 1983. Because of environmental investigation activities, 29 potential sources of contamination (PSCs) were identified as needing additional investigation. In December 1989, the base was placed on the National Priorities List (NPL). The FFA, signed in October 1990, outlined the regulatory path to be followed at NAS Pensacola. NAS Pensacola must complete not only the regulatory obligations associated with its NPL listing, but it also must satisfy the ongoing requirement of an environmental Resource Conservation and Recovery Act (RCRA) permit issued in 1988.

The RCRA permit is an authorizing document issued by the FDEP, as authorized by USEPA, to implement the requirements of hazardous waste management and environmental regulation. That RCRA permit addresses the treatment, storage, and disposal of hazardous waste, and the investigation and remediation of any releases of hazardous waste and/or constituents from Solid Waste Management Units at NAS Pensacola. The RCRA permit also governs ongoing use of hazardous wastes and the operating permit rules. RCRA and CERCLA investigations and actions are coordinated through the FFA, streamlining the cleanup process. Currently, the cleanup program is being conducted under the Navy's Installation Restoration (IR) program.

A Post Closure RCRA Permit Renewal application for NAS Pensacola was submitted to the FDEP in March 2006. Amendments to the original RCRA permit application were submitted in January 2007 and the RCRA Permit Renewal (Permit Number 0154498-005-HF) was completed in September 2008.

1.2.2 Land Use

Today, NAS Pensacola occupies 5,800 acres on a peninsula in southern Escambia County, five miles southwest of the city of Pensacola. The peninsula is bounded on the north by Bayou Grande and on the east and south by Pensacola Bay. Various housing, training, and support facilities are on the base. A large Naval Aviation Depot (NADEP) that repairs and refurbishes aircraft engines and frames was in the area surrounding Chevalier Field. Most industrial operations were conducted in the older portion of the base, which is at the eastern end of the peninsula. The NADEP was decommissioned in September 1995. The western end is taken up by the main airfield (Forrest Sherman Field) and undeveloped forest land (EnSafe, 1996a).

1.2.3 Physiography and Topography

NAS Pensacola is located in the extreme southeastern portion of Escambia County, Florida, which lies within the Coastal Plain Province of the United States. As described in the Initial Assessment of NAS Pensacola (NEESA, 1983), NAS Pensacola lies within the coastal lowland that is characterized by a series of broad, nearly level marine terraces that extend several miles from the coast and merge with the narrow terraces along the Escambia and Perdido Rivers. NAS Pensacola is located on a peninsula with gently sloping terrain. The land surface elevations on the peninsula range from sea level to approximately 40 feet above mean sea level.

1.2.4 Climate

Escambia County has a warm, humid-temperate climate (USDA, 2004). Along the coast, the Gulf of Mexico moderates high temperatures in the summer and low temperatures in the winter. Total annual precipitation is about 62 inches. The greatest amount of rain falls in July and August. Occasionally, short droughts occur in late spring.

1.2.5 Soil

Soil at NAS Pensacola developed in marine terrace sediment deposits and is regionally classified by the United States Department of Agriculture (USDA), Soil Conservation Service as the Pelham-Mascotte-Sapelo soil series assocation. Soils in this association are characterized as nearly level, poorly drained sands to a depth of 20 inches below land surface (bls), which are underlain by loamy sands (USDA, 2004).

1.2.6 Regional Geology

The surficial geology of the area consists of Pleistocene marine deposits made up of light brown to tan, fine quartz sand with associated stringers and lenses of gravel and clay. Underlying these deposits, increasing with age, are the Citronelle Formation, the Miocene Coarse Clastics, the Pensacola Clay, the Tampa Formation, the Chickasawhay Limestone, the Bucatunna Clay member of the Byram Formation, the Ocala Group, the Lisbon equivalent, the Tallahatta Formation, and the Hatchetigbee Formation. The Pleistocene deposits and Citronelle formation are often impossible to differentiate, and together range in thickness from approximately 30 feet to 800 feet across Escambia County (NEESA, 1983).

1.2.7 Regional Hydrology

1.2.7.1 Surface Water

NAS Pensacola is bordered on the south by Big Lagoon, on the south and east by Pensacola Bay, and on the north by Bayou Grande (NEESA, 1983). Sandy surface soil in this area allows for a high proportion of rainfall to infiltrate into the ground and consequently there are few streams. The surface topography has little dissection and the natural drainage system is poorly developed. Much of the surface drainage has been constructed or modified to accommodate structures on base. Swampy areas exist at or near the western portion of NAS Pensacola, and man-made drainage ways and storm drains feed into the short intermittent streams that empty into Pensacola Bay and Bayou Grande. Perennial streams do not enter or exit NAS Pensacola, but marshy areas and three small lakes on the golf course are persistent throughout the year.

1.2.7.2 Groundwater

Groundwater in Escambia county occurs in three major aquifers: a shallow aquifer which is both artesian and non-artesian (the sand and gravel aquifer), and two deep artesian aquifers (the upper and lower limestone of the Floridan aquifer). In the southern half of the area, the sand and gravel aquifer and the upper limestone of the Floridan aquifer are separated by a thick section of relatively impermeable clay; but, in the northern half of the area the sand and gravel aquifer and the upper limestone of the Floridan aquifer are in contact with one another. The upper limestone of the Floridan aquifer is separated from the lower limestone by a thick clay bed (NEESA, 1983).

The sand and gravel aquifer is composed of sand but has numerous lenses and layers of clay and gravel. The formation also contains lenses of hardpan where the sand has been cemented by iron oxide minerals. This aquifer lies at the surface throughout Escambia County. Boring logs from various locations at NAS Pensacola show that the surficial sands extend from ground surface to a depth of approximately 35 feet mean sea level below (approximately 50 feet bls) which is a 15-foot thick marine clay, the continuity of which is uncertain. Underlying the clay is more sand with numerous clay lenses (Geraghty and Miller, 1986).

Water levels in the shallow aquifer range from 0 to approximately 30 feet bls across the NAS Pensacola area. The groundwater flow has historically been found toward the Gulf of Mexico and the Escambia and Perdido rivers although groundwater flow can vary locally due to the effect of topography or surface water bodies. The aquifer recharge is predominantly from local precipitation (Geraghty and Miller, 1986).

The shallow saturated permeable beds in the sand and gravel aquifer contain groundwater under non-artesian conditions, while the deeper permeable beds contain groundwater under artesian pressure, where they are confined by lenses of clay and sandy clay (NEESA, 1983).

Below the sand and gravel aquifer, the limestone layers comprise the regionally extensive Floridan aquifer, which in this area is divided into upper and lower units separated by the Bucatunna clay. The upper Floridan aquifer is an important source of water in areas east of Escambia County; however, in the Pensacola area it is highly mineralized and not used as a water supply. The lower Floridan aquifer is also highly mineralized and is designated for use as an injection zone for waste disposal in this area (Geraghty and Miller, 1986).

1.3 ARAR CHANGES AND SITE-SPECIFIC ACTION LEVEL CHANGES

The Applicable or Relevant and Appropriate Requirements (ARARs) identified in each of the RODs were reviewed to determine if they had been updated since the last Five-Year Review. An evaluation of chemical, action, and location ARARs was conducted as appropriate for each OU. These evaluations are addressed specifically in each OU review section.

1.4 NEXT REVIEW

USEPA has indicated all future Federal Facility Five-Year Reviews will be due on the date five years from the remedial action start date. For NAS Pensacola the remedial action start date was March 12, 1999. Because although the OU1 ROD was signed by the Navy August 19, 1998; the on-site construction of the treatment system did not begin until March 12, 1999. The first Five-Year Review was signed by the Navy on February 3, 2003. The second Five-Year Review was signed by the Navy August 22, 2008. Navy guidance (DON, 2011) specifies that “the Five-Year Review and report for a site shall be completed and signed by the DON within five years of the trigger date for that site. Subsequent Five-Year Review reports shall be signed by the DON no later than five-years after the signature date of the previous Five-Year Review report.” Therefore this Five-Year Review is due August 22, 2013, five years after the prior Five-Year Review was signed.

2.0 OPERABLE UNIT 1

The OU1 ROD was signed on August 19, 1998 and implementation of the remedial actions at OU1, began in 1999. The initial Five-Year Review for OU1, an inactive sanitary landfill also referred to as Site 1, was completed in 2003. This Five-Year Review consists of an approximate five-year period of data and provides a status update for OU1. This statutory review is required by regulation because landfill wastes are still contained on site and do not allow for UU and UE.

2.1 SITE CHRONOLOGY

Historical events and relevant dates in the OU1 chronology are summarized in Table 2-1.

TABLE 2-1
OU1 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Domestic and industrial wastes from NAS Pensacola and other outlying Navy facilities were disposed of at OU1	Prior to 1974
Discovery of landfill leachate discharge	1974
Monitoring wells installed to investigate the leachate discharge	1975
Landfill officially closed	1976
Initial Assessment Study (IAS) – OU1 was recommended for further investigation due to the presence of metals in the leachate	1983
Verification Study – monitoring wells were installed to collect groundwater samples to confirm the IAS results	1984
Characterization Study – monitoring wells were installed to collect groundwater samples to determine the nature and extent of the contamination	1986
NAS Pensacola placed on NPL	1989
Contamination Assessment / Remedial Activities Investigation	1991
Final Remedial Investigation (RI) Report issued	January 5, 1996
Focused Feasibility Study (FS) issued	November 1997
Proposed Plan issued for public comment issued	December 1997
Final ROD issued	September 25,1998
Conceptual Remedial Design issued	1998
Final Remedial Design issued	1999
Removal Action – 73 tons of material was removed	1998
Start of on-site construction of treatment system (Phase 1) (trigger date)	March 12, 1999

TABLE 2-1
OU1 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Navy issues Memorandum of Agreement (MOA) for LUCs	March 31, 1999
Completion of on-site construction of treatment system	May 7, 1999
Treatment system testing, startup, and performance monitoring	June 1999
Long-term Groundwater Monitoring Plan issued	July 1999
Final Declaration of the Explanation of Significant Differences (ESD) to send groundwater remedial system water to wastewater treatment plant (WWTP) instead of wetland recharge	August 23, 1999
MOA signed by responsible parties	September 24 1999
Completion Report issued	March 2000
Operation and Maintenance (O&M) Manual for Groundwater Treatment and Recovery System issued	March 2000
O&M begins	March 2000
1st Annual Groundwater Monitoring Report issued	January 2001
2nd Annual Groundwater Monitoring Report issued	September 4, 2002
Initial Five-Year Review Report issued	February 2, 2003
49.83 Acre tract of land associated with OU1 transferred to the Veterans Administration (VA)	May 23, 2002
Initial Final Optimization Study issued	August 3, 2004
3rd Annual Groundwater Monitoring Report issued	April 30, 2003
FDEP “Optimization Study” comments issued	November 3, 2004
Revised Optimization Study and Implementation Plan issued	September 2005
5th Annual Groundwater Monitoring Report issued	December 2006
Final Revised Optimization Study issued	November 29, 2007
Second Five-Year Review Report issued	August 6, 2008
Reconnaissance Phase Flow Control Pilot Study	February 11, 2009
Decommission of the Groundwater Interception System	May 2010
Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) approved	November 2010
2010 Annual Groundwater Monitoring Report issued (Draft)	August 11, 2011
2011 Annual Groundwater Monitoring Report issued (Draft)	July 2012
Declaration of the ESD to discontinue groundwater interceptor trench and move surface water monitoring point (draft)	March 30, 2012

2.2 BACKGROUND

2.2.1 Physical Characteristics of OU1

OU1, also referred to as Site 1, is an inactive sanitary landfill encompassing approximately 85-acres (Figure 2-1). The landfill surface varies from 8 to 20 feet above mean sea level and is densely vegetated with 15- to 40-foot tall planted pines and natural scrub vegetation. The landfill is bordered by an inland water body (Bayou Grande) to the north, by the A.C. Read Golf Course to the east, and by areas of natural scrub vegetation and Barrancas National Cemetery to the west and south. Bayou Grande has been classified by the FDEP as a Class III water body, indicating its use for recreation and maintaining a well-balanced fish and wildlife population. Beyond the scrub vegetation, Taylor Road lies approximately 200 feet south of the site.

2.2.2 Land and Resource Use at OU1

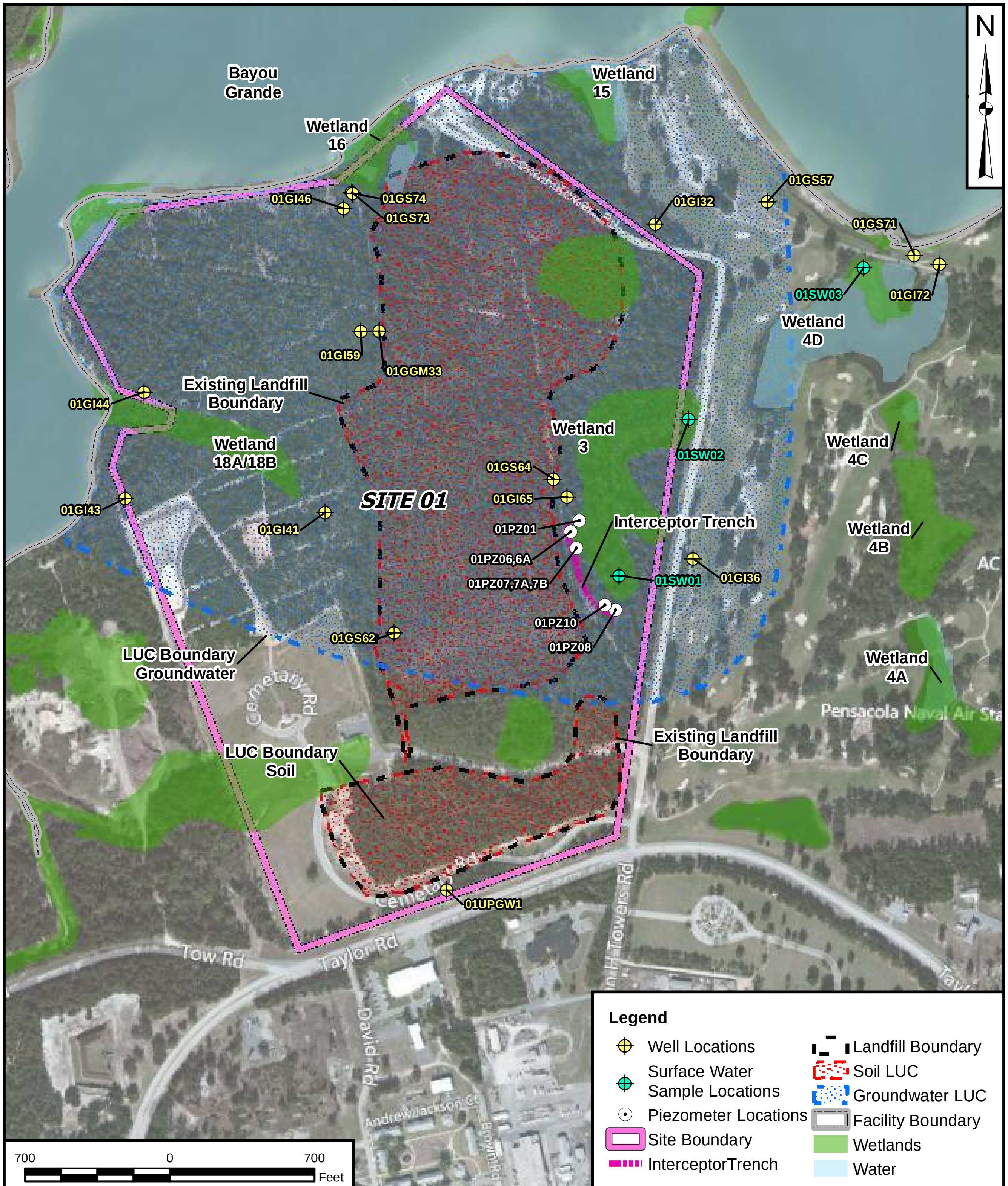
From the early 1950s until 1976, domestic and industrial wastes from NAS Pensacola and other outlying Navy facilities were disposed at OU1. Industrial wastes consisted of ketone-, poly-chlorinated biphenyl (PCB)-, and transformer oil-soaked rags; paint chips; paint sludge; compressed air cylinders; asbestos; and garbage. The facility was officially closed on October 1, 1976 (EnSafe, 1998).

The land use for the areas immediately north of the landfill include a Boy Scout camp, a nature trail, a picnic area, and recreational Buildings 3553 and 3487. Also in this general area are two tidal-inlet ponds with associated wetlands. Other wetland areas are located to the west and east of the landfill; most are associated with marshy intermittent creeks.

On May 23, 2002, 49.83 acres of uplands located immediately adjacent to the south and southwest portion of OU1 was transferred to the VA. This purpose of this transfer was to provide for expansion of the Barrancas Military Cemetery and construction of an administration building, and a facility maintenance building.

The nearest residential area (base housing) is approximately 1,000 feet south of OU1. Potable water for this residential area and all of NAS Pensacola is supplied from Corry Station, approximately three miles north of NAS Pensacola. Groundwater flow is generally northward, toward Bayou Grande and adjacent surface water features, with components to the northwest and northeast (EnSafe, 1998).

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU1Site1.mxd [alex.montalvo 7/17/2012]



DRAWN BY	DATE			CONTRACT NUMBER	CTO NUMBER
GIS	7/17/2012	NAVFAC	SITE MAP - OPERABLE UNIT 1 5 YEAR REVIEW NAS PENSACOLA PENSACOLA, FLORIDA	112G00702	067
CHECKED BY	DATE			APPROVED BY	DATE
A.I.	7/17/2012			____	____
REVISED BY	DATE			APPROVED BY	DATE
				____	____
SCALE AS NOTED				FIGURE NO. 2 - 1	REV 0

2.3 HISTORY OF CONTAMINATION AT OU1

Landfill leachate was discovered in 1974 to be discharging from an abandoned drainage field into a nearby golf course pond. Groundwater samples from this area were found to contain phenol and several metals. Additional groundwater investigations (Verification and Confirmation Studies) indicated the presence of volatile organic compounds (VOCs) and trace concentrations of semivolatile organic compounds (SVOCs). It was determined that groundwater contamination (exceedance of federal and state regulatory criteria) by VOCs, SVOCs, and metals was limited to the areas within and around the landfill perimeter. However, several metals were determined to be leaching from site soils to the shallow groundwater and migrating to Wetland 3. Also, a tar pit was identified during the RI, which posed a physical hazard to site trespassers (EnSafe, 1998).

2.3.1 Initial Response for OU1

The physical hazard presented by the tar pit was initially addressed. Analytical results from the Toxicity Characteristic Leaching Procedure (TCLP) of samples collected from the tar pit in 1993 indicate that the tar was not considered a hazardous waste. A total of 73 tons of tar was excavated in January 1998 and disposed at a Subtitle D landfill to remove the physical hazard and potential for release of chemicals to the environment.

2.3.2 Basis for Taking Action at OU1

An RI was completed for OU1 in January 1996. Contaminants were detected in groundwater at concentrations that could cause unacceptable risk for future residents at OU1. Contaminants of concern (COCs) are summarized in Table 2-2.

TABLE 2-2
OU1 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Medium	Contaminants Causing Unacceptable Risk
Groundwater	Arsenic, barium, cadmium, manganese, nickel, vinyl chloride, benzene, chlorobenzene, and chloroform

During the human health risk assessment (HHRA) it was determined that exposure to chemicals of potential concern (COPCs) in surface and subsurface soil and groundwater was within USEPA's generally acceptable ranges for the trespassing child and the potential future site worker. However, exposure to COCs in the shallow/intermediate and deep groundwater (Table 2-2) presented an unacceptable risk via the ingestion and inhalation exposure pathways for the hypothetical future site resident. Unacceptable risk was not projected for exposure by current and future site residents and workers and trespassers to the surface and subsurface soil (EnSafe, 1998).

Ecological risks were determined to be inconsequential for flora and fauna from the ecological contaminants of potential concern (ECOPCs) in soil. Appreciable ecological effects were not expected from groundwater discharge to wetlands, other than Wetland 3. The risk to ecological receptors at Wetland 3 was evaluated by comparing the concentrations of ECOPCs detected in sediment and surface water samples to established screening values from FDEP and USEPA Region 4 guidance. Based on the evaluation of the ECOPCs, the OU1 ecological COCs included metals and pesticides. Benthic community species and fish in downgradient sections of the wetland were determined to be potentially exposed to an unacceptable excess risk. Methods proposed to assess potential unacceptable risk to receptors for Phase IIB of the Site 41 RI were bioassays for benthic and fish species. Bayou Grande (Site 40) and NAS Pensacola wetlands were to be evaluated in the RI for Site 41.

2.4 REMEDIAL ACTION

2.4.1 Remedy Selection at OU1

The ROD for NAS Pensacola OU1 was signed by the Navy on August 19, 1998 and approved September 25, 1998. Remedial Action Objectives (RAOs) were developed as a result of data collected during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD.

The purpose of the remedial action at OU1 was to reduce the unacceptable risks to human health and environment associated with exposure to COCs in groundwater and surface water and protect groundwater from the leaching of waste in the landfill from soil to groundwater. To meet these goals, three RAOs were identified. Table 2-3 lists the RAOs for OU1.

**TABLE 2-3
OU1 REMEDIAL ACTION OBJECTIVES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA**

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives

TABLE 2-3
OU1 REMEDIAL ACTION OBJECTIVES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Groundwater	Arsenic, barium, cadmium, iron, manganese, nickel, vinyl chloride, benzene, chlorobenzene, and chloroform	Prevent current or future unacceptable exposure to contaminated groundwater
Surface Water	Iron	Prevent further contamination of surface water
Waste	VOCs, SVOCs, PCBs, pesticides, antimony, cadmium, chromium, lead, mercury, and nickel	Protect groundwater from leaching compounds

In the FS for OU1, four remedial alternatives were evaluated to address the three RAOs. Of the four alternatives evaluated, the selected remedial action for OU1 was Alternative 2C as listed in the ROD for OU1. The major components of Alternative 2C are listed below:

- Institutional controls imposed to restrict groundwater use of the surficial zone of the sand and gravel aquifer within 300 feet of the site.
- Institutional controls imposed to limit intrusive activities within the landfill boundary without prior approval from the NAS Pensacola Environmental Office.
- Annual review of the institutional controls and certification that the controls should remain in place or be modified to reflect changing site conditions.
- Groundwater monitoring to ensure that the natural attenuation processes are effective.
- A review during which the Navy would determine whether groundwater performance standards continue to be appropriate and if natural attenuation processes are effective.
- Continued groundwater monitoring at regular sampling intervals after performance standards are attained. The groundwater monitoring program would continue until a Five-Year Review concludes that the alternative has achieved continued attainment of the performance standards and remains protective of human health and the environment.

- A groundwater interception system to capture the contaminated groundwater upgradient of Wetland 3. The intercepted groundwater will be treated to reduce iron levels before being reintroduced into Wetland 3.

- Concentrations of the organic compounds present in the groundwater and surface water will be reduced through natural attenuation resulting from naturally occurring biotic and abiotic processes, which take place in the groundwater and surface water systems.

2.4.2 Remedy Implementation at OU1

The remedial action was organized into two phases. The first phase included the design and construction of the treatment system. The second phase included the long-term groundwater monitoring plan. The remedial action selected for implementation at OU1 is consistent with CERCLA and the NCP.

The final Remedial Design was prepared by Bechtel Environmental, Inc. (BEI) and was included as a component of the Remediation Work Plan/Remedial Design for Phase I Groundwater Treatment and Recovery System at Operable Unit 1 (BEI, 1999a). BEI initiated remedial activities on March 12, 1999 and completed the installation of the groundwater interception system, on May 7, 1999. The installation of electrical utilities, system startup, and performance monitoring were performed during the period of June 8 through June 17, 1999. The Long-term Groundwater Monitoring Plan for Phase II Remedial Action was issued by BEI in July 1999. The long-term monitoring (LTM) program included groundwater monitoring, MNA, and surface water sampling two times per year for years one through three, then annually until the COCs are below performance standards (BEI, 1999b).

Additional remedial construction activities were completed when the UFP-SAP was updated in July 2010 and approved in November 2010. The updated UFP-SAP provided for installation of six new groundwater monitoring wells (four replacement and two new monitoring wells), and monitoring of the new wells, eight piezometers/staff gauges, 11 existing monitoring wells, and three surface water sampling locations (Tetra Tech, 2010). Groundwater samples are analyzed for VOCs and metals, and surface water samples are analyzed for total iron as specified in the ROD.

2.4.3 Land Use Restriction Agreement

As specified in the final ROD for OU1 (EnSafe, 1998), the institutional controls for OU1 are imposed using a Land Use Restriction Agreement (LURA). The LURA was actually completed in the form of a MOA as agreed by the USEPA, FDEP, and the Navy.

Attached as an appendix to the MOA is a Land Use Control Implementation Plan (LUCIP) for OU1, which provides the site description, site location, LUC objectives, LUC implementation to achieve objectives, and the reference decision document.

The LUCIP specified:

- The NAS Pensacola IR Manager shall be responsible and coordinate inspections of this site. Any discrepancies will be forwarded to NAS Pensacola Facilities Officer for correction to maintain the objectives.

- Institutional controls shall be imposed to restrict groundwater use of the surficial zone of the sand and gravel aquifer within 300 feet of the site boundaries.

- No intrusive activities shall be permitted within the site boundaries without prior approval from the NAS Pensacola Environmental Office.

- The NAS Pensacola IR Manager will submit an annual review of the institutional controls and certification that the controls should remain in place or be modified to reflect changing site conditions.

- Groundwater shall be monitored down gradient of the site to ensure natural attenuation processes are effective and contaminants above state and federal levels are not being discharged into adjacent surface waters.

- The groundwater interception system installed to capture contaminated groundwater upgradient of Wetland 3 will continue operation with the effluent being treated prior to being discharged and shall be maintained until performance standards that are acceptable to both FDEP and USEPA are achieved.

- The groundwater monitoring program will continue until a Five-Year Review concludes that the alternative has achieved continued attainment of the performance standards and remains protective of human health and the environment.

2.4.4 System Operation/Operation and Maintenance at OU1

The Navy operated the groundwater interception system from June 1999 until May 2010. The effectiveness of the groundwater interception system was evaluated during an Optimization Study, a Five-Year Review, and Reconnaissance Phase Flow Control Pilot Study as discussed below.

Optimization Study: The Optimization Study found that although the groundwater interception system could contribute to reducing some iron concentrations within shallow groundwater, surface water data indicated that the groundwater interception system was not having an appreciable effect on the overall iron concentrations in surface water within Wetland 3 because of the prevalence of iron within the shallow groundwater upgradient, side-gradient, and downgradient to the groundwater interception system. Furthermore, the Optimization Study found that attenuation of iron is naturally occurring in Wetland 3. The mechanisms by which this is occurring are believed to be physical, chemical, and biological. Based upon field observations, physical processes including natural sedimentation appear to be occurring where the iron flocculent is dropping out of suspension.

Additionally, field observations also indicated that vegetation in Wetland 3 appears to be growing with little to no stress. This is a good indication that, as identified in the ROD and documented by the Interstate Technology and Regulatory Council (2003), the native vegetation is likely contributing to the reduction of the iron via several mechanisms including sedimentation, adsorption, oxidation, biological, and phytodegradation of the iron. The vegetation also provides an unspecified amount of evapotranspiration in the wetland which aids in treatment.

2008 Five-year Review: The 2008 Five-year Review found that the concentrations of iron detected in groundwater samples collected from monitoring wells located downgradient from the interceptor trench system (ITS) continue to exceed both the Florida Class III Predominantly Marine surface water quality criteria of 1,000 micrograms per liter (µg/L) and the maximum contaminant level (MCL) for iron of 300 µg/L as specified in Chapter 62-550, Florida Administrative Code (F.A.C.), as well as the site-specific background concentration for freshwater wetlands of 2,360 µg/L.

The Five Year Review concurred with the 2006 Optimization Study and concluded that: performance of the groundwater interception system does not appear to be sufficient to capture and extract the iron contamination migrating to the wetland. Furthermore, even if the groundwater interception system was effectively capturing and treating the local groundwater (which it does not appear to do based upon the elevated iron concentrations in groundwater immediately downgradient of the groundwater interception system) the prevalence of iron within the shallow groundwater upgradient, side-gradient, and downgradient to the groundwater interception system would make achievement of the RAOs for surface water in Wetland 3 impractical with the existing system.

Reconnaissance Phase Flow Control Pilot Study: The Reconnaissance Phase Flow Control Pilot Study concluded that groundwater currently discharges to surface water in Wetland 3 and that the groundwater-surface water interaction pattern cannot be changed unless the surface water level is increased to 7.07 feet at the inlet of the culvert. Also, because of the high groundwater elevations southeast of the culvert, it was not clear whether a surface water infiltration area could be created by increasing the surface water elevation at Wetland 3. The study also determined that due to the relatively low elevation of John Tower Road near the culvert, blocking the culvert would result in flooding over the road and golf course. Therefore, it was recommended that no further evaluation of flow control be conducted.

Additionally, iron background concentrations were updated as part of the Reconnaissance Phase Flow Control Pilot Study because rather dissimilar “pristine” wetlands (Wetlands 27 and 33) were originally used to establish background values for all wetlands at NAS Pensacola. The iron background concentrations for freshwater and estuarine wetlands were reevaluated because: the original data set was small and non-representative, highly variable iron concentrations have been detected in the over 80 freshwater and estuarine wetlands at NAS Pensacola, and many of the wetlands contain iron at naturally occurring concentrations that exceeded the original background value. The new freshwater wetland background threshold was determined to be 4,720 µg/L and the new estuarine wetland background threshold was determined to be 5,862 µg/L.

Also, monitoring on an annual basis at a new monitoring location was implemented because surface water iron concentrations in Wetland 4D are less than or nearly equal to the new estuarine wetland background threshold of 5,862 µg/L. The new location was established in Wetland 4D because it receives water from the southwestern side of Wetland 3 and from Wetlands 4A-4B-4C at the southeastern side of Wetland 4D. The new location represents surface water quality in Wetland 4D prior to where it drains to Bayou Grande through a culvert near the northern corner of the wetland. The point-of-compliance location is approximately midway between the mixing point of the two water sources and the culvert.

Based on the findings of the Optimization Study, the 2008 Five-Year Review, and a Reconnaissance Phase Flow Control Pilot Study for Wetland 3, operation of the groundwater interception system was subsequently discontinued.

2.4.5 Long-Term Groundwater Monitoring at OU1

Beginning in December 1999, the Navy contracted Tetra Tech to perform the long-term groundwater monitoring for OU1. In August 2001, the contract was modified to add the O&M for the groundwater remediation system. Semiannual sampling events have been conducted in March 2000, August 2000, May 2001, November 2001, May 2002, October 2002, June 2003, November 2003, June 2005, December 2005, May 2010, November 2010, August 2011, and January 2012. Semiannual sampling events were not conducted from November 2003 through May 2010. LTM was not conducted from 2004 to 2005 due to extensive hurricane damage throughout the facility. Semiannual sampling events were also not conducted during the Optimization Study and Reconnaissance Phase Flow Control Pilot Study. Semiannual sampling was resumed after review and approval of the Data Quality Objectives and UFP-SAP submitted in July 2010 and approved in November 2010. The semiannual sampling is being conducted as directed by the OU1 ROD, Long-Term Groundwater Monitoring Plan (LTGMP), and the O&M Manual. The completed activities for LTM include:

- The first year of groundwater and surface water sampling (semi-annually), natural attenuation monitoring (semiannually), and annual reporting of results (report dated January 2001).

- The second year of groundwater and surface water sampling (semiannually), natural attenuation monitoring (semiannually), and annual reporting of results (report dated September 2002).

- The third year of groundwater and surface water sampling (semiannually), natural attenuation monitoring (semiannually), and annual reporting of results (report dated April 2003).

- The fifth year of groundwater and surface water sampling (semiannually), natural attenuation monitoring (semiannually), and annual reporting of results (report dated December 2006).

- The sixth year of groundwater and surface water sampling (semiannually), natural attenuation monitoring (semiannually), and annual reporting of results (draft final report dated January 2012).

- The seventh year of groundwater and surface water sampling (semiannually), natural attenuation monitoring (semiannually), and annual reporting of results (draft report dated March 2012).

As stated in the ROD for OU1 (EnSafe, 1998), the Navy’s original 1996 cost estimate for implementation of remedial action and closure of OU1 and 30 years of LTM program (risk-reduction) was $4,542,600. The approximate cost to date for remedial actions including O&M and monitoring at OU1 is $1,754,466.

2.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

A draft ESD was issued for OU1 on March 30, 2012 to address discontinued operation of the groundwater interceptor trench and make changes to groundwater and surface water monitoring procedures. The 2007 Optimization Study, 2008 Five-Year Review, and 2009 Reconnaissance Phase Flow Control Pilot Study recommend the pumping operation of the groundwater interception system be discontinued due to lack of unacceptable human health or ecological risk associated with iron concentrations in Wetland 3, prevalence of background iron concentrations across the facility, and inability of the groundwater interception system to address iron from all sources. Changes to O&M as presented in the ESD include:

- Sampling and analysis for total iron from two monitoring wells and four piezometers.
- Monitoring of surface water at Wetland 3 at locations 01SW01 and 01SW02. Surface water monitoring location 01SW01 has been moved approximately 250 feet south of the previous location, and a new surface water monitoring location, 01SW03, has been established in Wetland 4. The surface water RAO for prevention of further contamination of surface water in Wetland 3 is no longer required because prevention of groundwater discharge from OU1 to Wetland 3 is not required for protection of human health and the environment.

2.5.1 Protectiveness Statements from the Last Review

Based on the results of the 2008 Five-Year Review, the remedy was expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through natural attenuation. In the interim, exposure pathways that could result in unacceptable risks were being controlled and institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater.

Issues identified in the 2008 Five-Year Review, and actions taken are summarized in Table 2-4.

TABLE 2-4
OU1 ISSUES IDENTIFIED AND ACTIONS TAKEN
2008 FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Issues Identified in 2008 Five-Year Review	Actions Taken Since the 2008 Five-Year Review
Down-gradient monitoring wells have been destroyed by Hurricane Ivan. The Optimization Study proposes replacement of destroyed wells.	Five monitoring wells were installed in 2009. Three of the wells were replacement wells, whereas the remaining two monitoring wells were located hydraulically downgradient.

2.5.2 Status of Recommendations and Follow-up Actions from Last Review

Table 2-5 provides a list of recommendations, recommended follow-up actions from the 2008 Five-Year Review, milestone dates, actions taken, outcomes, and dates of action.

TABLE 2-5
OU1 RECOMMENDATIONS AND FOLLOW-UP ACTIONS
2008 FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Yes or No)	
					Current	Future
1	Implement Treatment System optimization and additional remedial options (ongoing)	Navy	USEPA	N/A		Yes
2	Continue the assessment of the feasibility of alternative engineering controls at Wetland 3 (ongoing)	Navy	USEPA	N/A		Yes
3	Replace monitoring wells and implement optimization strategy	Navy	USEPA	N/A		Yes

2.5.2.1 Actions Taken and Outcome for Item 1 from Table 2-5

The groundwater interception system groundwater treatment system was decommissioned in May 2010, based on recommendations of the Optimization Study, 2008 Five-Year Review, and the Reconnaissance Phase Flow Control Pilot Study. In addition, modifications were made to the monitoring program related to the groundwater interception system ITS and Wetland 3. A draft ESD has been issued to document these changes.

2.5.2.2 Actions Taken and Outcome for Item 2 from Table 2-5

Monitoring of surface water at Wetland 3 will continue at locations 01SW01 and 01SW02. Surface water monitoring location 01SW01 has been moved approximately 250 feet south of the previous location, and a new surface water monitoring location, 01SW03, has been established in Wetland 4. The surface water RAO for prevention of further contamination of surface water in Wetland 3 is no longer required because prevention of groundwater discharge from OU1 to Wetland 3 is not required for protection of human health and the environment.

2.5.2.3 Actions Taken and Outcome for Item 3 from Table 2-5

The Optimization Study proposed replacement of monitoring wells destroyed by Hurricane Ivan. Five monitoring wells were installed in 2009. Three of the monitoring wells were replacement wells, while the other two monitoring wells were located hydraulically downgradient of OU1.

2.6 FIVE-YEAR REVIEW PROCESS

This is the third Five-Year Review for this site. Members of the NAS Pensacola Partnering Team were notified of the initiation of the Five-Year Review in January 2012. The Five-Year Review was led by Gerald Walker of Tetra Tech, the NAVFAC SE Navy CLEAN Contractor, and included other Tetra Tech staff. Patty Marajh-Whittemore of NAVFAC SE, Greg Campbell of NAS Pensacola Public Works Department, Tim Woolheater of USEPA, David Grabka of FDEP, and Sam Naik of CH2M Hill assisted in the review.

The review included the following components:

- Document Review
- Data Review
- Site Inspection
- Five-Year Review Report development and review

2.6.1 Document Review

This Five-Year Review consisted of a review of relevant documents including the RI Report, the FS, the Proposed Plan, the ROD, the Construction Completion Report, the O&M Manual for Groundwater Treatment and Recovery System, the LTGMP, Annual Monitoring Reports, the Optimization Study, the draft ESD, and applicable federal and state statutes.

2.6.2 Data Review

2.6.2.1 Review of COC Data for Groundwater

Groundwater monitoring is documented in annual reports prepared by Tetra Tech in March 2000, January 2001, September 2002, April 2003, December 2006, August 2011 (draft), and July 2012 (draft). Since the initial ROD was signed, six years of semiannual monitoring and sampling have occurred; though the years are not consecutive. LTM was not conducted from 2004 to 2005 due to extensive hurricane damage throughout the facility. Later, groundwater monitoring was not conducted during the evaluation of the groundwater interception system by the Optimization Study (final report Nov 2007) and Reconnaissance Phase Flow Control Pilot Study (completed February 2009).

The ROD and LTM Plan (BEI, 1999b) established the groundwater COCs as benzene, chlorobenzene, vinyl chloride, nickel, naphthalene, xylene, 1,1,2,2-tetrachloroethane, aluminum, cadmium, chromium, iron, and manganese. During the first year of monitoring xylenes, cadmium, iron, manganese, benzene, vinyl chloride, and chlorobenzene were detected at concentrations exceeding the Cleanup Target Levels (CTLs) established by the ROD. During the second year of monitoring, benzene, vinyl chloride, xylene, aluminum, cadmium, iron, and manganese were detected at concentrations exceeding their CTLs. During the third year of monitoring, benzene, chlorobenzene, vinyl chloride, aluminum, iron and manganese were detected above their CTLs. During the fifth year of monitoring, down-gradient groundwater quality monitoring wells 01GS57 and 01GS71 were found to be destroyed and could not be sampled. The analysis of groundwater samples collected in June and December 2005 revealed the presence of seven COCs at concentrations exceeding their respective CTLs. Manganese, aluminum, and iron were the only metals from the COC list with exceedances. Iron and manganese exceedances were distributed evenly across the study area, and four VOCs (benzene, chlorobenzene, xylene, and vinyl chloride) were detected at concentrations exceeding current FDEP criteria. VOC exceedances were limited to monitoring wells located on the perimeter or adjacent to the main body of the old landfill.

The groundwater at OU1 was evaluated in light of the changes in the number of monitoring well locations with contaminants that exceed CTLs, and the changes in contaminant concentrations at individual monitoring well locations with time. The trend analysis for the COCs for groundwater at NAS Pensacola was performed using the Mann-Kendall test (ProUCL Version 4.1.00 [Lockheed Martin Environmental Services, 2010]) at a 95 percent confidence level and groundwater sample data collected from 1993 to 2011. The Mann-Kendall test is used because it does not assume any particular distributional form and accommodates values below the detection limit by assigning them a common value.

During the May and November 2010 groundwater sampling events, 17 monitoring wells and 8 piezometers were sampled and analyzed for the 12 groundwater COCs. Only seven of the COCs were detected in groundwater samples exceeding their respective Groundwater Cleanup Target Levels (GCTLs). Manganese, aluminum, cadmium, and iron were the only metals that exceeded their CTLs. Based on the locations sampled, aluminum, iron and manganese exceedances appeared to be distributed across the OU1 area. Three VOCs (benzene, chlorobenzene, and vinyl chloride) were detected at concentrations exceeding their respective CTLs.

During the August 2011 groundwater sampling event, 15 monitoring wells and 8 piezometers were sampled and analyzed for the 12 groundwater COCs. During the January 2012 groundwater sampling event, 16 monitoring wells and 8 piezometers were sampled and analyzed for the 12 groundwater COCs. Only six of the COCs were detected in groundwater samples exceeding their respective CTLs.

Manganese, aluminum, and iron were the only metals that exceeded their CTLs. Based on the locations sampled, aluminum, iron, and manganese exceedances appeared to be distributed across the study area. Three VOCs (benzene, chlorobenzene, and vinyl chloride) were detected at concentrations exceeding their respective CTLs.

Comparison of the 2010, 2011, and 2012 groundwater sampling data with previous groundwater sampling data suggests the trends in the concentrations of the COCs observed in May 2010, November 2010, August 2011, and January 2012 are consistent with the long-term concentration trends for most of the monitoring wells.

Mann-Kendall Trend analysis results are provided in Appendix A. In general, the test results indicated that for all of the COCs, most monitoring wells demonstrate no significant trend or have a statistically significant downward trend identified, especially for benzene and vinyl chloride. A statistically significant upward trend is identified at a limited number of monitoring wells for iron, manganese, and/or chlorobenzene. Mann-Kendall Trend analysis data sheets and graphs of the contaminant concentrations versus time are provided in the Appendix A.

2.6.2.2 Review of Natural Attenuation Data for Groundwater

The UFP-SAP for LTM at OU1 (Tetra Tech, 2010) indicates that: "Because contaminant monitoring is the primary goal and monitoring is expected to continue for a long time, inclusion of these parameters was not considered to be important at this time. As part of the optimization strategy, however, inclusion of natural attenuation parameters to verify or support an evaluation of why the contaminant concentrations are decreasing may be useful and should be considered during the optimization evaluations. In the meantime, groundwater well stabilization parameters will be collected to support the initial evaluations of natural attenuation. The groundwater well stabilization parameters include: dissolved oxygen (DO), ORP, pH, specific conductance, temperature, and turbidity by field instrument."

Groundwater field parameters that were measured during the August 2011 and January 2012 LTM groundwater sampling events included pH, specific conductance, turbidity, temperature, dissolved oxygen (DO), and oxidation reduction potential (ORP).

ORP values for the shallow aquifer zone monitoring wells sampled during the August 2011 sampling event ranged from -56.5 to 132.7 millivolts (mV) and for the January 2012 sampling event ranged from -9.9 to 146.8 mV. ORP values for the piezometers sampled during the August 2011 sampling event ranged from -149.3 to 27.3 mV and for the January 2012 sampling event ranged from -125.1 to 65.6 mV. ORP values for the intermediate aquifer zone monitoring wells sampled during the August 2011 sampling event ranged from -183.9 to 154.4 mV and for the January 2012 sampling event ranged from -210.4 to 118.2 mV. The ORP values are generally within a range that suggests that reductive pathways for natural attenuation are possible or likely.

DO concentrations for the shallow aquifer zone monitoring wells sampled during the August 2011 sampling event ranged from 0.18 to 1.44 milligrams per liter (mg/L) and for the January 2012 sampling event ranged from 0.26 to 6.73 mg/L. DO concentrations for the piezometers sampled during the August 2011 sampling event ranged from 0.14 to 0.42 mg/L and for the January 2012 sampling event ranged from 0.16 to 0.40 mg/L. DO concentrations for the intermediate aquifer zone monitoring wells sampled during the August 2011 sampling event ranged from 0.12 to 0.47 mg/L and for the January 2012 sampling event ranged from 0.18 to 1.04 mg/L. The DO values are generally within a range that suggests that reductive pathways for natural attenuation are tolerated.

2.6.2.3 Review of Surface Water COC Data

In addition to groundwater and natural attenuation monitoring, surface water monitoring of iron concentrations has also been conducted in Wetland 3 since March 2000. During the monitoring period, surface water samples collected from Wetland 3 continued to present iron concentrations exceeding Florida surface water standards and NAS Pensacola site specific background criteria. The iron concentrations remain less than the 700,000 to 1,800,000 µg/L concentrations reported in August 2000.

Total iron concentrations reported for surface water location 01W01 during these sampling events were lower than results reported for the previous two years of monitoring. Iron concentrations reported for down-gradient surface water location 01W02 have been variable, fluctuating by an order of magnitude between sampling events with no apparent trend. The fluctuation may be a result of a number of factors including differential rates of flow and solubility changes brought on by temperature variations (Tetra Tech, 2006c).

Surface water samples were collected at three locations as part of two semiannual sampling events conducted in August 2011 and January 2012. Two of the surface water sample locations are in Wetland 3, which is located adjacent to and downstream of OU1. Surface water sample 01SW01 is located at a groundwater to surface water seep area in the southwestern portion of Wetland 3 (which is approximately 250 feet south of the previous location) and 01SW02 is located prior to the culvert that connects Wetland 3 to Wetland 4. The third surface water sample location, 01SW03, is the Point of Compliance (POC) sample location in Wetland 4D for the discharge of surface water from Wetland 4 into Bayou Grande.

Surface water sample location 01SW01 contained total iron at concentration of 5,220 µg/L and surface water sample location 01SW02 contained total iron at 7,050 µg/L during the November 2010 sampling event. Both locations contained total iron at concentrations that exceed the freshwater background concentration of 4,720 µg/L. Surface water sample location 01SW03 contained total iron at concentration of 427 µg/L.

During the August 2011 and January 2012 sampling events, surface water sample location 01SW01 could not be sampled because the seep location was dry. In August 2011, surface water sampling location 01SW02 contained total iron at a concentration of 12,900 µg/L, which exceeds the freshwater background concentration 4,720 µg/L. The concentrations of total iron for the August 2011 sampling events at surface water sample location 01SW02 at Wetland 3 exceeded the Class III surface water quality criteria of 1,000 µg/L per Chapter 62-302, F.A.C. The concentration of total iron at surface water sample location 01SW03 during the August 2011 sampling event was 265 µg/L, and 291 µg/L for the duplicate sample. Neither surface water sample contained total iron at a concentration that exceeded the estuarine wetland background threshold of 5,862 µg/L and the Class III surface water quality criteria per Chapter 62-302, F.A.C.

Surface water sampling location 01SW02 contained total iron at 6,500 µg/L, and 5,840 µg/L for the duplicate sample, which exceeds the freshwater background concentration 4,720 µg/L. The concentrations of total iron for the January 2012 sampling event at surface water sample location 01SW02 at Wetland 3 also exceeded the Class III surface water quality criteria of 1,000 µg/L per Chapter 62-302, F.A.C. The concentration of total iron at surface water sample location 01SW03 (point of compliance location) during the January 2012 sampling event was 347 µg/L, which is below the estuarine wetland background threshold of 5,862 µg/L and the Class III surface water quality criteria per Chapter 62-302, F.A.C.

Surface water samples collected from Wetland 3 during the 2011 and 2012 sampling events continued to have iron at concentrations exceeding FDEP surface water standards. However, the iron concentrations detected in 2011 and 2012 are considerably lower than the concentrations (700,000 to 1,800,000 µg/L) detected in 2000.

Because the source for total iron in surface water that discharges into Wetland 3 is a seep discharging from the former OU1 landfill, it is recommended that the surface water sample locations 01SW01, 01SW02, and 01SW03 should continue to be monitored. The semiannual sampling schedule should be preserved. Continuation of the semiannual monitoring would help ensure that potential sources of known and unknown contaminants are protective of human health and the environment and are attaining groundwater cleanup goals through natural attenuation.

2.6.2.4 LUC Inspections

LUC inspections were conducted annually at OU1 during the period under review. The inspections noted no problematic observations; however, occasional comments indicate that a small amount of plant growth consisting of weeds, shrubs, and small saplings were observed in the west and southwest drainage channels. Copies of the annual certifications are provided in Appendix B.

2.6.3 Site Inspection and Interviews

An inspection was conducted at the site on May 3, 2012 by Tetra Tech and NAS Pensacola personnel. The purpose of the inspection was to assess the protectiveness of the remedy, including the condition of the monitoring wells, and the condition of the wetlands.

The institutional controls that are in place include the restriction of groundwater use within 300 feet of the site and limiting intrusive activities within the landfill boundary without prior approval from the NAS Pensacola Environmental Office. At the time of the inspection, institutional controls were found to be adequate, and use of groundwater was not observed. Roadways within OU1 appeared adequate and there were no apparent signs of vandalism or trespassing. During a separate regulatory site visit in 2011, an OU1 monitoring well was observed to be open and several additional monitoring wells were unlocked or in disrepair. Following the site visit, the Navy completed immediate monitoring well repair and initiated a facility wide monitoring well inventory to assess the condition of all existing monitoring wells. It was noted during the Five-Year Review inspection that fencing and signs are in place to notice the restricted access to Barrancas National Cemetery, but not specifically for restricting access to OU1.

According to the NAS Pensacola Environmental Office, 49.83 acres was transferred to the VA on May 23, 2002 to provide additional burial plots and space for construction of administrative and maintenance building structures. A portion of the land transferred from the Navy to the VA was inadvertently located in OU1. The location of the VA transferred land located inside the OU1 boundary is depicted on Figure 2-1. As evidenced by this figure, the VA out parcel encompasses a portion of the southern soil LUC boundary for OU1.

An interview was conducted with Greg Campbell, Environmental Engineer for NAS Pensacola, on May 2, 2012. According to the interview, Mr. Campbell indicated he is well informed about the site's activities and progress, and was not aware of any community concerns regarding the site or its operation, or of any incidents such as vandalism, trespassing, or emergency responses at the site. The interview forms are presented in Appendix B.

Mr. Campbell indicated annual LUC inspections are performed. In addition, complaints, violations, or other incidents related to the site requiring a response by his office have not occurred. Mr. Campbell indicated his opinion that the closure of the iron recovery system was appropriate.

2.6.4 ARAR Level Changes

The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- RCRA MCLs (40 CFR 264 Subpart F)
- Federal Safe Drinking Water Act MCLs (40 CFR 141.11 – 141.16)
- Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.50 – 141.51)
- Florida Water Quality Standards, Chapter 62-3, F.A.C.
- Florida Surface Water Standards, Chapter 62-301 and 302, F.A.C.
- Florida Drinking Water Standards, Chapter 62-550, F.A.C.

Florida Water Quality Standards, Chapter 62-3, F.A.C., was repealed in 2000 and minimum groundwater quality criteria is currently provided in Ground Water Classes, Standards, and Exemptions, in Chapter 62-550, F.A.C. The action levels for triggering contingent action at OU1 are the Florida surface water standards for Class III freshwater and the Florida drinking water standards.

New surface water monitoring criteria was presented in the Reconnaissance Phase Flow Control Pilot Study completed in March 2009. The freshwater wetland background threshold for iron was determined to be 4,720 µg/L and the estuarine wetland background threshold was determined to be 5,862 µg/L.

Contaminant CTLs, Chapter 62-777, F.A.C. (Amended 4/17/05) and Contaminated Site and Cleanup Criteria, Chapter 62-780, F.A.C. were promulgated by Florida after the ROD and establish cleanup levels for soil, groundwater, and surface water. These new criteria need to be considered to determine if the remedy is still protective. Chapter 62-777, F.A.C. provided GCTLs for contaminants without MCLs per Chapter 62-550, F.A.C. Additionally, Chapter 62-777, F.A.C. provided surface water cleanup target levels (SWCTLs) for contaminants that did not have surface water quality criteria listed in Chapter 62-302, F.A.C. The Chapter 62-777, F.A.C. SWCTLs are applicable for surface water and for groundwater discharging to surface water (both fresh and saline environments). As described in the previous Five-Year Review, the concentrations of four contaminants (trans-1,2-dichloroethene, 1,2-dichloroethane, 1,4-dichlorobenzene, and chlorobenzene) that are not listed in Chapter 62-302, F.A.C but are listed in Chapter 62-777, F.A.C. were not detected in Wetland 3 surface water samples. Thus, the use of the CTLs provided in Chapter 62-777, F.A.C. does not affect the protectiveness of the groundwater remedy.

Chapter 62-780, F.A.C. provides rules for the assessment and cleanup of non-petroleum sites with contaminants that have been released or discharged into the environment and Chapter 62-785, F.A.C. provides rules for assessment and cleanup of Brownfields sites. Rules promulgated per Chapter 62-780, F.A.C. and Chapter 62-785, F.A.C. do not affect the protectiveness of the remedy.

Since signing the ROD for OU1 on August 19,1998, changes to federal regulations in 2002 and 2006 and to Florida regulations in 2005 lowered the MCL for arsenic in groundwater from 50 to 10 µg/L. On January 22, 2001, the USEPA adopted a new MCL for arsenic in drinking water at 10 µg/L, replacing the old standard of 50 µg/L. The USEPA rule became effective on February 22, 2002 and became enforceable to water systems on January 23, 2006. Florida's drinking water standards are contained in Chapter 62-550, F.A.C. Florida's primary drinking water standards, which are health based, are described in Rule 62-550.310, F.A.C. Florida changed its MCL for arsenic from 50 µg/L to 10 µg/L on January 1, 2005. This change in the federal and state MCL for arsenic is being implemented in a draft ESD for OU1.

There have been no other changes in Safe Drinking Water Act and Chapter 62-550, F.A.C. MCLs that affect the protectiveness of the remedy.

The Wetlands Protection Policy, authorized under Executive Order 11990, remains unchanged and is the only location-specific ARAR for OU1.

The following standards were identified as action-specific ARARs for OU1, governing actions such as the construction of landfills:

- RCRA Groundwater Monitoring Requirements (40 CFR 264 Subpart F)
- Clean Water Act Discharge Limitations National Pollutant Discharge Elimination System (NPDES) Permit (40 CFR 122, 125, 129, 136)
- Pretreatment Standards (40 CFR 403.5)
- Safe Drinking Water Act Underground Injection Control Program (40 CFR 144)
- Florida Rules on Permits, Chapter 62-4, F.A.C. (Amended 02/16/12)
- Florida Underground Injection Control Regulations, Chapter 62-528, F.A.C. RCRA Solid Waste Groundwater Monitoring Requirements

The Florida rules on permits (F.A.C. Chapter 62-4) were amended on February 16, 2012. The amendments to this rule do not affect the protectiveness of the remedy. The groundwater interception system was decommissioned in May 2010, so NPDES, Pretreatment Standards, and 62-4, F.A.C. are no longer pertinent. There is no underground injection, so the underground injection control regulations are no longer pertinent. The remaining standards remain unchanged and are RCRA requirements.

2.7 TECHNICAL ASSESSMENT

The following conclusions support the determination that the remedy at OU1 is expected to be protective of human health and the environment.

2.7.1 Question A: Is the remedy functioning as intended by the ROD?

Remedial Action Performance: Prior to decommissioning in May 2010, the groundwater interception system remedy was functioning, on a mechanical basis, as designed; however, the groundwater interception system was not effectively treating iron contaminated groundwater migrating from the OU1 landfill and discharging into Wetland 3, as is evidenced by the elevated iron concentrations present in Wetland 3 surface water. The design and subsequent performance of the trench was not sufficient to capture and extract all of the iron contamination migrating to Wetland 3 from OU1 because of the prevalence of iron within the shallow groundwater upgradient, side-gradient, and downgradient to the groundwater interception system. In summary, the groundwater interception system was not meeting, or expected to meet, the reductions necessary for cleanup.

The concentrations of iron at surface water sample locations 01SW01 and 01SW03 during the January 2012 sampling event were below the freshwater background concentration, and the iron concentration at surface water sample location 01SW02 exceeded the freshwater background concentration.

Considering that Wetland 3 is already an integral part of the treatment process for iron, it is expected that iron concentrations in Wetland 3 will remain stable and may decrease over time. The results from the surface water samples should be monitored to confirm that the iron concentrations do not exceed the 4,720 µg/L freshwater wetland background value and the estuarine wetland background of 5,862 µg/L at the point of compliance location (01SW03).

System Operations/O&M: The groundwater interception system groundwater treatment system was decommissioned in May 2010.

Cost of System Operations/O&M: System operations and O&M cost-to-date from 1999 to 2012 for the groundwater recovery and treatment system were approximately $1,754,466.

Opportunities for Optimization: The Optimization Study was approved by the USEPA on March 29, 2007. All FDEP comments were addressed in correspondence dated November 27, 2007.

Because the groundwater interception system was not meeting the RAOs, modification of the existing remedy was necessary. The necessary modifications included establishment of ecological based risk criteria to determine the overall protectiveness of the remedy related to the seep at Wetland 3, modification of the RAO for protection of Wetland 3 as it was no longer required, and additional surface monitoring to evaluate the concentrations and effects of iron within Wetland 3.

The Optimization Study found that Wetland 3 is naturally treating the iron and field observations indicate healthy vegetative growth in Wetland 3. The vegetation also provides an unspecified amount of evapotranspiration in the wetland which aids in treatment.

Implementation of Institutional Controls and Other Measures: The MOA was completed on August 31, 1999, and was approved and authorized by the responsible parties including USEPA, FDEP, and the Navy. The LUCIP was included as an appendix to the MOA. OU1 is reported to have been inspected quarterly to insure the institutional controls remain in place and an Annual Review Report has been completed. No water supply wells are within the area restricted by the LUCIP.

2.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure Assumptions: There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and To Be Considered (TBC) Criteria: ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes to standards since the remedy was implemented. The arsenic MCL per the Safe Drinking Water Act, and Chapter 62-550, F.A.C has been changed from 50 µg/L, which is the Performance Standard in the ROD, to 10 µg/L.

Changes in Exposure Pathways: No changes in the site conditions or land use that affect exposure pathways were identified as part of the Five-Year Review.

Changes in Toxicity and other Contaminant Characteristics: Toxicity and other factors for COCs have not changed.

Changes in Risk Assessment Methodologies: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

2.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information that could call into question the protectiveness of the remedy has been discovered.

2.8 ISSUES

Issues were discovered during the Five-Year Review and are noted in Table 2-6.

TABLE 2-6
OU1 ISSUES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Issues	Affects Protectiveness (Y/N)	
	Current	Future
The ESD, which includes a revised surface water monitoring program to ensure protectiveness of surface water, is currently in regulatory review. The new monitoring program has been implemented, but is awaiting formal regulatory approval.	No	No

2.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Continue surface water monitoring in accordance with the draft ESD.

2.10 PROTECTIVENESS STATEMENT

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through natural attenuation. The remedy is protective in the short term as institutional controls are currently being implemented. The surface water monitoring program being is implemented as part of LTM, as described in the draft ESD, allows for protectiveness of the remedy.

3.0 OPERABLE UNIT 2

The OU2 ROD was signed by the Navy on September 29, 2008 and by the USEPA on September 30, 2008. Implementation of remedial action at OU2 began in 2008. This Five-Year Review consists of an approximate five-year period of data and provides a status update for OU2 which consists of Site 11- North Chevalier Field Disposal Area, Site 12- Scrap Bins, Site 25- Radium Spill Area, Site 26- Supply Department Outside Storage Area, Site 27- Radium Dial Shop Sewer, and Site 30- Complex of Industrial Buildings and Industrial Wastewater Treatment Plant (IWTP) Sewer Line.

This Five-Year Review for OU2 is being conducted because contaminated soil and groundwater are still contained on site and do not allow for UU and UE.

3.1 SITE CHRONOLOGY

Historical events and relevant dates in the OU2 chronology are summarized in Table 3-1.

**TABLE 3-1
OU2 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA**

Event	Date
Garbage stored at Site 12	Early 1930s – 1940s
Waste disposal activities initiated at Site 11	Late 1930s – Mid 1940's
Aircraft and parts were painted with cellulose nitrate lacquer, zinc chromate, nitrate dope, acetate dope, "day glow," epoxy, and enamel in the Building 649 complex at Site 30. Thinners used were lacquer thinner, toluene, and MT 6096.	1940
Building 709 at Site 27 constructed for several operations including carburetor repair, propeller repair, painting and maintenance, various instrument shops (including a radium paint room), and a plating shop.	1941
Building 709 at Site 27 housed a large plating operation.	1941 – 1970 or 1973
Benzene stripping of luminous instrument dials in Building 709 at Site 27	1941 – 1965
Tin-cadmium plating shop operated in the Building 649 complex at Site 30. Solutions of tin, cadmium, cyanide, trichloroethene, and waste oil stored on site.	Mid 1940s – early 1960s
Cleaning solutions containing benzene, white pigments, phosphorus, radium, and small amounts of acidic or caustic solutions Plating wastes from former Building 709 at Site 27 and shops in Buildings 604 and 649/755 were periodically dumped through drains into the sanitary sewer	1941 – 1962
All wastes from former Building 709 at Site 27 were discharged directly into Pensacola Bay	1941 – 1948

TABLE 3-1
OU2 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Wastewater treatment plant built at Site 30. The waste stream has included paint strippers, heavy metals, pesticides, radioactive wastes, fuels, cyanide waste, and waste oil.	1948
Concentrated cyanide wastes from Building 709 at Site 27 and Building 649 and 755 at Site 30 were periodically dumped into the sanitary sewer.	1941 – 1962
Magnesium treatment line replaced tin-cadmium plating in the Building 649 complex at Site 30. Solutions of acids, caustics, degreasers, chromate solutions, and potassium permanganate stored on site. A second plating shop in Building 755 at Site 30 contained metal plating solution including nickel, chromium, silver, lead, and tin.	Early 1960s – early 1970s
Cyanide from Building 709 at Site 27 and Building 649 and 755 at Site 30 was drummed and disposed 15 miles offshore in the Gulf of Mexico, although small quantities of cyanide continued to be discharged into the sewer	1962
Paint stripper and a lye-nitric or "Turco" acid solution stripping of luminous instrument dials in Building 709 at Site 27	1965
Oil slicks noted during heavy rains at Site 11	Until the 1950s
Building 780 Constructed at Site 25 to house oxygen and carbon dioxide shops	1951
Site 26 stored incoming paint strippers and acids	1956 – 1964
Wastewater treatment plant at Site 30 replaced with one that accepts industrial wastes. The waste stream has included paint strippers, heavy metals, pesticides, radioactive wastes, fuels, cyanide waste, and waste oil. The IWTP sewer line consisted of vitreous clay and cast-iron piping installed both before and after 1971	1971
Radium spill reported at Site 25	Approximately 1975
Radiological Affairs Support Office (RASO) conducted a Radiation Survey/Removal investigation of radium contamination in the sewer lines at the demolished Building 709 area (Site 27).	1976
IAS on-site survey	1982
IAS final report	June 1983
Confirmation Study issued	1984
Verification Study issued	July 1984
Fiberglass underground storage tank (UST) mounted in concrete stored JP-1/JP-5 (jet fuel) calibration fluid for use in Building 692 at Site 30	1986
Characterization Study Sites 11, 27, and 30	March 1986
RCRA Facility Assessment	1988
RCRA/Hazardous and Solid Waste Amendments (HSWA) Permit	August 1988
FFA signed by FDEP, USEPA, and the Navy	October 23, 1990
Phase I screening investigation conducted	1991
RI/Focused FS completed	December 1995

TABLE 3-1
OU2 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
RI Report filed	1997
RI Report Addendum issued	September 1999
MOA issued	September 24, 1999
Focused FS issued	May 2000
Focused FS Addendum issued	September 2001
HSWA permit (0154498 004 HF) renewed	January 16, 2002
Groundwater Monitoring Plan issued	2007
Remedial Design approved	September 19, 2007
Final ROD issued	September 19, 2008
Site 12 Partial soil excavation completed	2010-2011
Site 25 Soil excavation completed	(Date)
Site 27 Partial soil excavation completed	(Date)
Site 30 Radiological (RAD) survey completed	June 2012

3.2 BACKGROUND

3.2.1 Physical Characteristics of OU2

OU2 is comprised of six individual sites: Site 11- North Chevalier Field Disposal Area, Site 12- Scrap Bins, Site 25- Radium Spill Area, Site 26- Supply Department Outside Storage Area, Site 27- Radium Dial Shop Sewer, and Site 30- Complex of Industrial Buildings and IWTP Sewer Line. The OU is primarily paved or covered by buildings and is approximately 68 acres. The sites comprising OU2, described below, are north of Chevalier Field, near Murray Road, and west of Pensacola Bay.

Site 11

Site 11, shown in Figure 3-1, is a former landfill where industrial and municipal wastes were disposed of and burned from the late 1930s to the mid-1940s. The area occupies approximately 20 acres southwest of an extension of Bayou Grande called the Yacht Basin. Surface elevations at the site are approximately 5 feet above mean sea level, and the site surface slopes gently eastward toward Bayou Grande. Two prefabricated buildings, Buildings 3627 and 3628, were formerly located near the center of the site. Building 3445, south of the site's southeastern corner, is used to store outdated office equipment. Much of the site is covered with vegetation. Fenced areas to the north and south of Building 3445 are used for outside storage of boats, trucks, and heavy equipment. Pat Bellinger Road runs north-south through the center of Site 11.

According to the IAS conducted by the Naval Facilities Engineering Service Center (NFESC), the Site 11 landfill was used to burn refuse through the mid-1940s. During this time, it received combustibles such as fuels, solvents, and waste oil from aircraft engine overhauls. During landfill operations from the early 1930s to the 1940s, approximately 24 cubic yards of material were disposed of daily from several NAS Pensacola locations. During this time, an unknown number of 55-gallon drums of unknown contents were observed. Until the 1950s, oil slicks were observed during heavy rains in the Yacht Basin.

Site 12

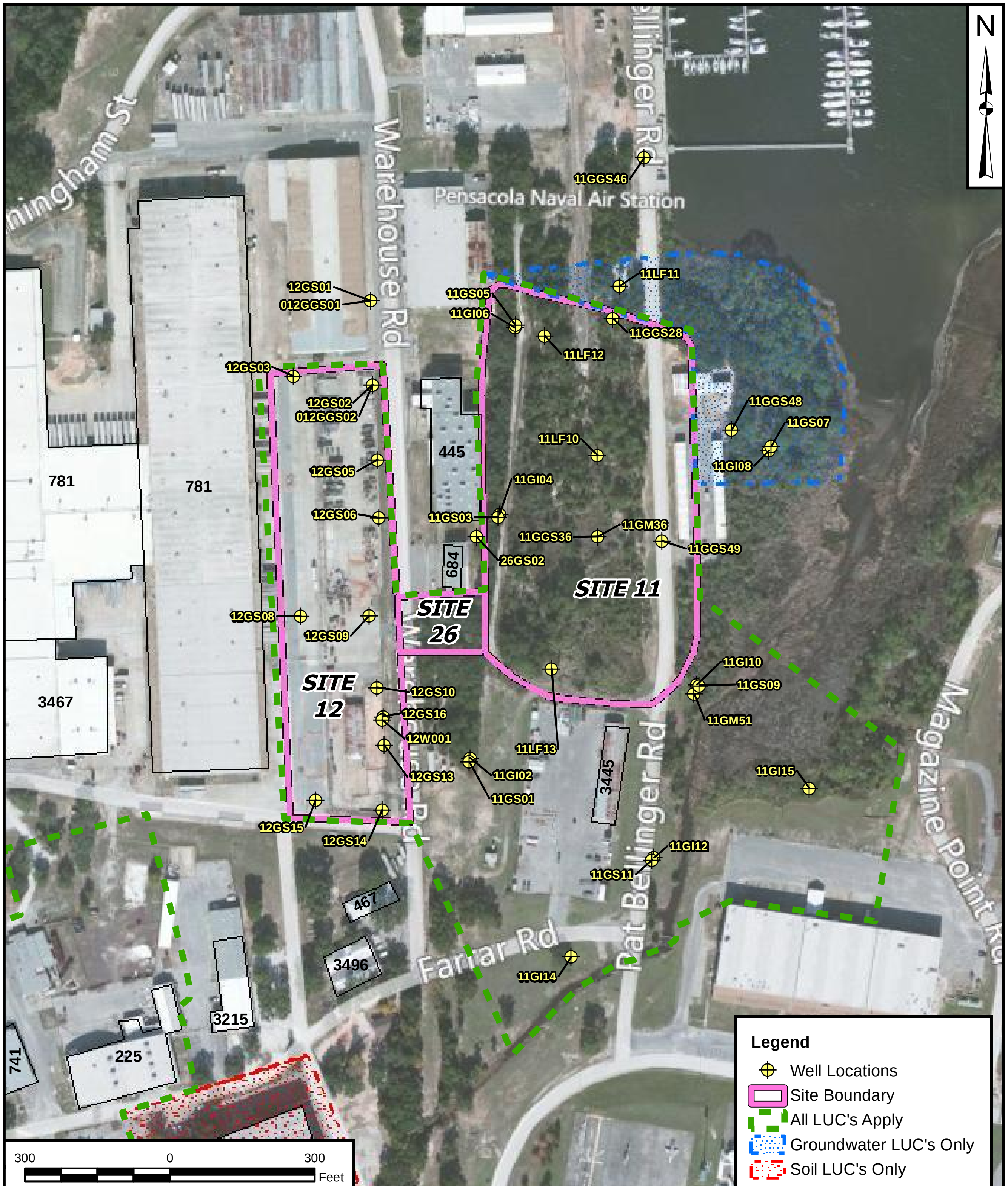
Site 12, shown in Figure 3-1, is currently referred to as the Defense Reutilization and Marketing Office (DRMO) Recyclable Materials Center and is used to store scrap metal. The site is approximately 800 feet northwest of former Chevalier Field and immediately west and upgradient of Site 26. Most of the site area is enclosed by a chain-link fence and covered with a large concrete pad which is used as a heavy equipment storage area. Buildings 455 and 3821 are in the southern portion of the site. Building 455 includes an office, break area, and storage warehouse, and Building 3821 is a storage warehouse. A third building, 3444, has been demolished.

From the early 1930s to the 1940s, garbage was stored at Site 12 in an area known as “Pig Sty Hill” near Building 455. Approximately 16 cubic yards (described as two truckloads) per day of wet garbage were stored here before being hauled off for livestock feed. The site has since been used for scrap metals storage.

Site 25

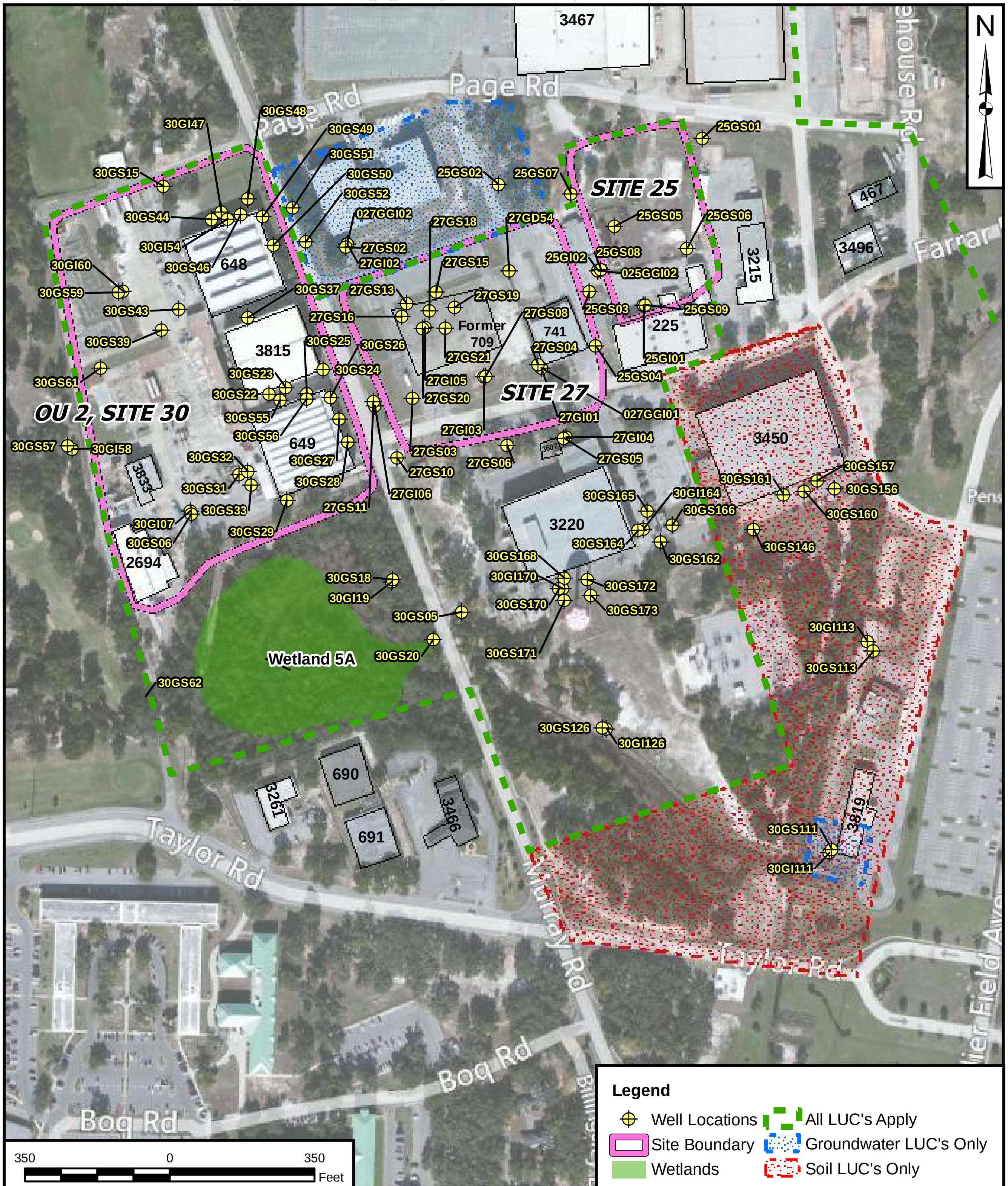
Site 25, shown in Figure 3-2, is an approximately 50-foot by 50-foot concrete-paved area located immediately east of Murray Road and north of Farrar Road. The site is flat with land surface elevations averaging approximately 22 to 25 feet above mean sea level. Where exposed, site surface soil is sandy and well drained. The site includes an area east of the radium decontamination building (Building 780) where a radium spill is reported to have occurred in 1978. A former helicopter scrap yard approximately 25 feet east of Building 780 is currently used as a parking area for Navy Exchange semi-trailers.

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU2Site11_12_26v2.mxd [alex.montalvo 7/17/2012]



DRAWN BY GIS	DATE 7/17/2012	SITE MAP - OPERABLE UNIT 2 5 YEAR REVIEW NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NUMBER 112G00702	CTO NUMBER 067
CHECKED BY A.I.	DATE 7/17/2012		APPROVED BY	DATE
REVISED BY	DATE		APPROVED BY	DATE
SCALE AS NOTED		NAVFAC	FIGURE NO. 3 - 1	REV 0

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU2Site25_27_30.mxd [alex.montalvo 7/17/2012]



DRAWN BY	DATE	SITE MAP - OPERABLE UNIT 2	CONTRACT NUMBER	CTO NUMBER
GIS	7/17/2012	5 YEAR REVIEW	112G00702	067
CHECKED BY	DATE	NAS PENSACOLA	APPROVED BY	DATE
A.I.	7/17/2012	PENSACOLA, FLORIDA	___	___
REVISED BY	DATE		APPROVED BY	DATE
			___	___
SCALE AS NOTED			FIGURE NO. 3 - 2	REV 0

NAVFAC

Building 780 currently houses the Joint Oil Analysis Laboratory, which is used for quality assurance analysis of oil from aircraft and vehicles. Building 780 was constructed in 1951 to house oxygen and carbon dioxide shops. In approximately 1975, a radium decontamination operation was added to Building 780. Radium wastes from this operation were stored in a drum on site before being disposed of. In 1978, a spill occurred in the storage area between Building 780 and the scrap yard. Approximately 25 gallons of low-level radium paint waste spilled from a ruptured, eroded drum onto the underlying concrete floor. The waste was reportedly cleaned, placed in a secure container, and sent to a proper disposal site. The exact location of the spill, details of the cleanup operation, and whether the waste reached unpaved soil were not determined from the existing records.

Site 26

Site 26, shown in Figure 3-1, is northwest of former Chevalier Field and immediately south of Building 684. The approximately 150-foot by 200-foot area houses an open metal shed near a former chemical storage building. DRMO uses this area to store paints, fuels, and solvents. Site access is limited by an 8-foot chain-link fence surrounding the storage area. The concrete pavement inside the fence is bordered by sandy soil and mowed grass. Site 26 is bounded on the west by a paved road and Site 12 and on the east by a wooded area (Site 11). The site gently slopes eastward to a topographic break where elevations abruptly drop to approximately 5 feet above mean sea level.

From 1956 until 1964, the supply department used Site 26 to store incoming paint strippers and acids. Containers of these materials placed outside on steel matting sometimes leaked, discharging the materials onto the ground.

Site 27

Site 27, shown in Figure 3-2, extends through the concrete foundation of former Building 709. The building was demolished and the foundation is currently a parking lot. The building foundation is 2 to 4 feet above the surrounding area. Outside the foundation the ground surface is unpaved. The site is approximately 150 feet west of Building 780 and bounded by Farrar and Murray Roads on the south and west, respectively. An adjacent parking lot north of the building foundation is asphalt-paved, and a gravel and shell parking lot is northeast of the foundation. All roads within the site are paved with either concrete or asphalt.

Originally, the site consisted of a small radium dial shop in former Building 709 with a connection to the sanitary sewer. However, the results of analysis of RI soil samples collected in the vicinity of the Building 709 foundation expanded the site area to approximately 6 acres.

Building 709, constructed in 1941, was used for several operations including carburetor repair, propeller repair, painting and maintenance, various instrument shops (including a radium paint room), and a plating shop. In 1949, a small shop in Building 709 was used to rework luminous instrument dials. Worn and damaged instruments were returned to this shop to be stripped and repainted. From 1941 to 1965, the stripping procedure required soaking the instruments in benzene, scraping them in a benzene or water bath, or dry scraping and painting them under a ventilation hood. After 1965, the procedure switched to scanning the instruments for radium and then stripping them with paint stripper and a lye-nitric acid solution. Contaminated instrument cases were soaked in another acid solution called “Turco” and then scrubbed with a wire brush.

Building 709 also housed a large plating operation from 1941 to approximately 1970. The operation involved the use of 50 solution tanks ranging from 50 to 3,865 gallons in capacity.

A routine disposal operation in former Building 709 involved washing spent cleaning solutions and luminous paint down the drains into the sanitary sewer. The disposed wastes from this location included cleaning solutions containing benzene, white pigments, phosphorus, radium, and small amounts of acidic or caustic solutions. Plating wastes from former Building 709 and shops in Buildings 604 and 649/755 were periodically dumped through drains into the sanitary sewer. Most of the building drains connected to a single line draining into the sanitary sewer line. From 1941 to 1948, all wastes from former Building 709 were discharged directly into Pensacola Bay. From 1941 to 1962, concentrated cyanide wastes from Building 709 were periodically dumped into the sanitary sewer. After 1962, the cyanide was drummed and disposed of 15 miles offshore in the Gulf of Mexico, although small quantities of cyanide continued to be discharged into the sewer. Plating operations ceased in Building 709 by 1973.

Site 30

Site 30, shown in Figure 3-2, covers approximately 35 acres and is also known as the Building 649 complex. The complex includes interconnected Buildings 647, 648, 649, 649B, 692, 755, and 3815 and several smaller, separate, associated buildings. The buildings were used by the Dynamic Component Division of the former NADEP and several aircraft component repair functions. In addition to the buildings, the Site 30 investigation included a portion of the sewer line from the Building 649 complex to the IWTP. The sewer line investigation included lines at Sites 25, 27, and 30 and their downstream segments along with the sewer extending from the Building 649 complex, the feeder line from Building 3220, and the main line running to the IWTP. Wetland 5A is located to the south of Site 30. Surface water from the wetland drains to the southeast to a ditch that flows northeastward to the Yacht Basin.

Operations in the Site 30 complex began in the 1940s and continued until NADEP closed. Aircraft and parts were painted in booths in the Building 649 complex beginning in 1940. The paints used at NAS

Pensacola were cellulose nitrate lacquer, zinc chromate, nitrate dope, acetate dope, “day glow,” epoxy, and enamel. Thinners used were lacquer thinner, toluene, and MT 6096.

A tin-cadmium plating shop operated in the Building 649 complex from the mid-1940s to the early 1960s. At this time, it was replaced by a magnesium treatment line, which operated until the early 1970s. Near Building 649, 15 tanks ranging in capacity from 200 to 500 gallons contained solutions of tin, cadmium, and cyanide. Additionally, a 250-gallon tank stored trichloroethene, and a 500-gallon UST, located on the northern end of Building 649, stored waste oil. The contents were drained periodically into a “ditch” east of the building. Based on current topography and historical data, this ditch was either Wetland 5A or a topographical low draining to Wetland 5A. When the tin-cadmium operation was replaced by a magnesium treatment line in the early 1970s, the 15 tanks near Building 649 were then used to store acids, caustics, degreasers, chromate solutions, and potassium permanganate.

In the summer of 1994 as part of an interim removal action (IRA), the NAS Pensacola Public Works Center (PWC) removed an aircraft engine shipping container from Wetland 5A immediately southeast of Building 649. The shipping container, referred to as the waste receiving structure, had been used as an oil-water separator. Wetland 5A was sampled under the Site 41 (NAS Pensacola Combined Wetlands) investigation. A second plating shop in Building 755 was used from the early 1960s until the early 1970s and included 50 tanks ranging in capacity from 50 to 200 gallons and containing metal plating solution including nickel, chromium, silver, lead, and tin.

Concentrated cyanide wastes generated in Buildings 649 and 755 were disposed of in the same manner as Building 709’s cyanide waste. Disposal involved discharging the wastes down the sewer from 1941 to 1962 and discarding drummed waste in the Gulf of Mexico after 1962. Cyanide waste generation stopped in the early 1960s when the tin-cadmium line was replaced by the magnesium treatment line. Overflow discharged into the sewer.

An empty fiberglass UST mounted in concrete is still located near the southeastern corner of Building 692. Installed in 1986, this tank stored JP-1/JP-5 (jet fuel) calibration fluid for use in Building 692. The fiberglass tank replaced an older steel tank also used to store calibration fluid. The older tank had at least one undocumented spill. A UST along the western side of Building 692 supplied Building 755 with methyl ethyl ketone via underground pipes. Several other USTs were located along the northern side of Building 692; their exact contents are unknown. Some of the storage tanks may have contained chromium wastes.

The original WWTP, built in 1948, was replaced in 1971 with a modern plant that could accept industrial wastes. Most facilities discharging to the sewer did so without any pretreatment or waste segregation.

The waste stream has included paint strippers, heavy metals, pesticides, radioactive wastes, fuels, cyanide waste, and waste oil. The IWTP sewer line consisted of vitrified clay and cast-iron piping installed both before and after 1971.

3.2.2 Land and Resource Use at OU2

OU2 is an industrial area, and because NAS Pensacola is not proposed for Base Realignment and Closure, it is reasonable to assume that the facility and OU2 will continue to be used for industrial or non-residential purposes in the foreseeable future. The groundwater at OU2 is not used at this time, and NAS Pensacola does not anticipate its future use. However, groundwater beneath OU2 is considered a potential source of drinking water (G-2) under Florida regulations.

3.3 HISTORY OF CONTAMINATION AT OU2

One soil sampling event during the RI was performed at all sites in OU2 and is summarized in the RI Report (EnSafe, 1997). Soil data identified constituents in surface and subsurface soil at concentrations greater than residential and industrial direct exposure Soil Cleanup Target Levels (SCTLs), and leachability to groundwater SCTLs per Chapter 62-777, F.A.C., and NAS Pensacola background concentrations. The estimated volume of soil that exceeds industrial SCTLs is 18,252 cubic yards.

RI groundwater sampling data were compared to Federal Safe Drinking Water Act, Florida Chapter 62-550, F.A.C. and Chapter 62-777, F.A.C. CTLs; Florida SWCTLs per Chapter 62-777, F.A.C.; and NAS Pensacola background concentrations to evaluate the nature and extent of contamination. NAS Pensacola background concentrations for aluminum, antimony, and iron exceeded their associated CTLs, indicating that these metals naturally occur at concentrations that exceed federal and state regulatory criteria at NAS Pensacola.

Based on data collected during the RI, the estimated volume of groundwater with aluminum, iron, and manganese at concentrations exceeding their CTLs is approximately 14,400,000 gallons. The estimated volume of groundwater with barium, cadmium, chromium, and lead at concentrations exceeding their CTLs is approximately 2,260,000 gallons. The estimated volume of groundwater with VOC concentrations exceeding their CTLs is approximately 13,500,000 gallons. The estimated volume of groundwater with SVOC at concentrations exceeding their CTLs is approximately 820,000 gallons. Although contaminants were detected in soil and groundwater samples, a strong correlation between soil and groundwater contamination was not identified in the RI Report.

3.3.1 Initial Investigation at Site 11

The source of contamination at Site 11 was identified as a former landfill, where trenching revealed evidence of a "seam" of blackened debris at the water table. This oily material contained corroded bits of metal and other debris. COCs for Site 11 are presented in Table 3-2.

3.3.2 Initial Investigation at Site 12

The storage of scrap metals may continue to contribute to the metals contamination at this site. Although it was not noted during the RI field investigation, past storage of old transformers pending their disposal may have contributed to the PCB contamination at Site 12. Residual fuels and oils from scrapped aircraft and vehicles stored at the site are possible sources of SVOCs. COCs for Site 12 are presented in Table 3-2.

3.3.3 Initial Investigation at Site 25

Improper storage and disposal of materials at Building 780 are possible sources of soil contamination at the site. Another location of concern at Site 25 is the storage yard north of Building 225, which was used as a metal prefabricating shop by the NAS Pensacola PWC. This yard contains racks of materials such as metal sheeting and piping. COCs for Site 25 are presented in Table 3-2.

3.3.4 Initial Investigation at Site 26

Possible sources of contamination include the storage of paints, fuels, and solvents. COCs for Site 26 are presented in Table 3-2.

3.3.5 Initial Investigation at Site 27

This site was originally investigated because of the sewer from the Radium Dial Shop. The sources of organic and inorganic contaminants are uncertain. The radiological survey revealed a small area of contamination south of former Building 709. From the size of the area, the contamination appeared to be from a spill adjacent to an old stairway from Building 709. Outside this limited area, significant soil radiological contamination was not found on this site. COCs for Site 27 are presented in Table 3-2.

3.3.6 Initial Investigation at Site 30

Maintenance operations such as painting, solvent use, and plating are the most likely sources of contamination at this site. COCs for Site 30 are presented in Table 3-2.

3.3.7 Basis For Taking Action at OU2

Concentrations of COCs in surface soil, subsurface soil, and groundwater were identified in the Human Health and Screening Level Ecological Risk Assessments that was presented in the RI Report and ROD (Tetra Tech, 2008b). The RI and ROD indicated the COCs present an unacceptable risk to human health for future site residents, future and current site workers, and adolescent trespassers, but did not result in unacceptable risks to ecological receptors (Tetra Tech, 2008b). COCs related to each medium at each site are summarized in Table 3-2.

TABLE 3-2
OU2 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Site	Medium	Contaminants Causing Unacceptable Risk
11	Groundwater	Aldrin, Arsenic, Barium, Benzene, Beryllium, Cadmium, Chloroform, Chromium, 1,1-Dichloroethene, 1,2-Dichloroethane, cis-1,2-Dichloroethene, 1,2-Dichloroethene (total), 1,2-Dichloropropane, Dieldrin, Naphthalene, 1,1,2,2-Tetrachloroethane, Tetrachloroethene, Trichloroethene, Vanadium, Vinyl chloride
11	Soil	Aluminum, Aroclor-1254, Aroclor-1260, Arsenic, benzo(a)pyrene equivalents (BEQs), Cadmium, Chromium
12	Groundwater	Aroclor-1260, Chloroform, 1,1-Dichloroethene, Dieldrin, Heptachor epoxide
12	Soil	Aluminum, Antimony, Aroclor-1254, Aroclor-1260, Arsenic, BEQs, Beryllium, Cadmium, Chromium, Copper, Manganese
25	Groundwater	Chloroform, 1,1-Dichloroethene, Mercury, Tetrachloroethene, Trichloroethene, Vinyl chloride
25	Soil	Aluminum, Aroclor-1254, Aroclor-1260, Arsenic, BEQs, Beryllium, Cadmium, Chromium, Dieldrin, Manganese, Mercury, Silver, Zinc
26	Groundwater	Arsenic, Cadmium, Dieldrin, Tetrachloroethene, Trichloroethene, Vinyl chloride

TABLE 3-2
OU2 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Site	Medium	Contaminants Causing Unacceptable Risk
26	Soil	BEQs
27	Groundwater	Chloroform, Chromium, 1,4-Dichlorobenzene, 1,1-Dichloroethane, 1,2-Dichloroethane, 1,1-Dichloroethene, 1,2-Dichloroethene (total), Dieldrin, 4-Methylphenol, Pentachlorophenol, Tetrachloroethene, 1,1,1-Trichloroethane, Trichloroethene, Vinyl chloride
27	Soil	Aluminum, Arsenic, BEQs, Beryllium, Cadmium, Chromium, Dieldrin, Manganese, Mercury, Silver
30	Groundwater	Arsenic, Barium, Benzene, Cadmium, Chloroform, Chromium, 1,4-Dichlorobenzene, 1,2-Dichloroethane, 1,1-Dichloroethene, Tetrachloroethene, 1,1,1-Trichloroethane, Trichloroethene, Vinyl chloride
30	Soil	Aluminum, Aroclor-1242, Aroclor-1254, Aroclor-1260, Arsenic, BEQs, Beryllium, Cadmium, Chromium, Dieldrin, Manganese

3.4 REMEDIAL ACTIONS

3.4.1 Remedy Selections at OU2

The ROD for NAS Pensacola OU2 was signed on September 29, 2008. RAOs were established in the FS to aid in the development and screening of remedial alternatives to be considered for the ROD.

The purpose of the remedial action at OU2 is to reduce the unacceptable risks to human health and the environment associated with exposure to COCs in groundwater and soil. To meet these goals, three RAOs were identified. Table 3-3 lists the RAOs for OU2.

TABLE 3-3
OU2 REMEDIAL ACTION OBJECTIVES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Groundwater	Aldrin, Aroclor-1260, Arsenic, Barium, Benzene, Beryllium, Cadmium, Carbon tetrachloride, Chlorobenzene, Chloroform, Chromium, 1,4-Dichlorobenzene, 1,1-Dichloroethane, 1,1-Dichloroethene, 1,2-Dichloroethane, cis-1,2-Dichloroethene, 1,2-Dichloroethene (total), 1,2-Dichloropropane, Dieldrin, Heptaclor epoxide, Mercury, Methylene chloride, 4-Methylphenol, Naphthalene, Pentachlorophenol, 1,1,2,2-Tetrachloroethane, Tetrachloroethene, 1,1,1-Trichloroethane, Trichloroethene, Vanadium, Vinyl chloride	Reduce human health risk from exposure to groundwater by reducing groundwater contamination at OU2 to meet Florida GCTLs
Soil	Aluminum, Antimony, Aroclor 1242, Aroclor 1254, Aroclor 1260, Arsenic, BEQs, Beryllium, Cadmium, Chromium, Copper, Dieldrin, Manganese, Mercury, Silver, and Zinc	Protect human health by eliminating or preventing exposure to contamination in surface soil that exceed Florida residential and commercial/industrial SCTLs
Soil	Aluminum, Antimony, Aroclor 1242, Aroclor 1254, Aroclor 1260, Arsenic, BEQs, Beryllium, Cadmium, Chromium, Copper, Dieldrin, Manganese, Mercury, Silver, and Zinc	Eliminate a continuing contamination source to groundwater by eliminating COCs in subsurface soil at concentrations that exceed Florida SCTLs for leachability

In the FS for OU2, five remedial alternatives for soil and seven remedial alternatives for groundwater were evaluated to address the three RAOs. Of the alternatives evaluated, the remedial actions selected for OU2 were Alternative S-5 for soil (Excavation and Off-site Disposal with LUCs) and GW-3 for groundwater (MNA and LUCs) as listed in the ROD for OU2. The major components of Alternative S-5 and GW-3 are listed below:

- Natural attenuation of contaminated groundwater primarily due to hydraulic dispersion, adsorption onto soil particles, and biodegradation.

- Excavation of soil contaminated by COC from Sites 11, 12, 25, 27, and 30, such that the average contaminant concentrations based on the 95 percent upper confidence limit meet the state of Florida industrial direct exposure SCTLs.

- Implementation of LUCs.

- Groundwater monitoring of natural attenuation.

The remedy was selected for the following reasons:

- After removal of soil identified for excavation, concentrations of COCs remaining in soil will no longer present an unacceptable threat to human health or the environment assuming that only non-residential uses of the sites are permitted. Surface soil areas identified as containing COCs at concentrations exceeding state of Florida industrial direct exposure SCTLs will be removed and replaced with clean fill to prevent unacceptable risks.

- Although contamination is present in groundwater at concentrations greater than federal and state CTLs, detected concentrations are relatively low and do not present an unacceptable risk to human health or the environment under the groundwater use restrictions to be implemented as part of the selected remedy.

- The contaminant plume is small and confined to the shallow aquifer.

Soil excavation for CERCLA contaminants originally planned for Site 11 will not be conducted due to a proposed change in remedy after discovery of asbestos containing material (ACM). The thickness of the existing soil cover will be evaluated and additional soil cover will be added, if necessary, in place of the hotspot soil excavation described in the ROD. Finding of ACM as a CERCLA contaminant and the change in the remedy selected in the ROD will be addressed in a Proposed Plan and ROD Amendment.

3.4.2 Remedy Implementation at OU2

3.4.2.1 MNA and Long-Term Monitoring

The OU2 ROD specified MNA of contaminated groundwater. Natural attenuation will rely on naturally occurring processes within the surficial aquifer to reduce contaminant concentrations in groundwater. Hydraulic dispersion through aquifer movement, adsorption on soil particles, and biodegradation will be the main attenuation processes. Surficial aquifer conditions will be periodically monitored to ensure contaminant concentrations are being adequately reduced through natural processes. This component of the remedy has not yet been implemented.

3.4.2.2 Excavation and Off-Site Disposal of Contamination

The OU2 ROD specified removal and off-site disposal of soil impacted by the COCs to reduce the direct exposure potential at the site. The combined areas of contaminated soil that will be evaluated for excavation covers approximately 246,400 square feet. Excavations will be advanced to a depth of 2 feet bls. In the ROD it was estimated that the maximum volume of soil to be excavated and disposed is 18,250 cubic yards. The ROD also indicated that the excavation limits and estimated maximum volume of soil to be excavated and disposed of may change based on criteria for additional samples needed to determine excavation limits as part of the Remedial Design.

3.4.2.3 Land Use Controls

The OU2 ROD specified that following soil excavation, LUCs will be implemented for soil and groundwater. Following soil excavation, soil and groundwater contamination will remain at OU2 at concentrations that preclude UU and UE; therefore, the remedy includes LUCs to prevent unacceptable risk due to exposure to the COCs remaining in soil above residential direct exposure criteria and groundwater. The OU2 LUC Boundaries are shown on Figures 3-1 and 3-2. Consistent with the RAOs developed for the OU, the specific performance objectives for the LUCs implemented at OU2 are as follows:

- Prohibit reuse of the site for residential uses including, but not limited to, any form of housing, child-care facilities, any kind of school including preschools, elementary schools, and secondary schools, playgrounds, and adult convalescent or nursing care facilities.

- Prohibit the excavation, disturbance, and removal of soil unless prior written approval is obtained from the facility's Environmental Coordinator.

- Prohibit potable uses of groundwater from the surficial aquifer underlying the site, including, but not limited to, drinking, washing, cooking, cleaning, and turf irrigation, without prior written approval from the Navy, USEPA, and FDEP.

- Prevent unacceptable occupational exposure to contaminated groundwater in the surficial aquifer by requiring the use of personal protective equipment (PPE) and monitoring equipment for excavations that may encounter groundwater.

- Maintain the integrity of any existing or future monitoring or remediation system(s).

Any time that part of OU2 is considered for an alternative use, a site approval process will be initiated through the NAS Pensacola Environmental Office. Similarly, for any intrusive activities that are planned within OU2, the Dig Permit process will be initiated through the NAS Pensacola Environmental Coordinator. The restricted area will be delineated and the restriction will be described in the NAS Pensacola Site Management Plan. Enforcement will be achieved through NAS Pensacola's site approval and Dig Permit processes. The site use and Dig Permits must be approved by the NAS Pensacola Environmental Office before any intrusive or construction activities are performed. Re-evaluation will be required for any change in land use.

3.4.3 System O&M at OU2

There is no remedial system at OU2; therefore, there are no costs for system O&M.

3.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

3.5.1 Protectiveness Statements from the Last Review

This is the first Five-Year Review since approval of the ROD in 2008; therefore, no previous protectiveness statement is available.

3.5.2 Status of Recommendations and Follow-up Actions from Last Review

This is the first Five-Year Review since approval of the ROD in 2008; therefore, there are no follow-up actions.

3.6 FIVE-YEAR REVIEW PROCESS

This is the first Five-Year Review for OU2. Members of the NAS Pensacola Partnering Team were notified of the initiation of the Five-Year Review in January 2012. The Five-Year Review was led by Gerald Walker of Tetra Tech, the NAVFAC SE Navy CLEAN Contractor, and included other Tetra Tech staff. Patty Marajh-Whittemore of NAVFAC SE, Greg Campbell of NAS Pensacola Public Works Department, Tim Woolheater of USEPA, David Grabka of FDEP, and Sam Naik of CH2M Hill assisted in the review.

The review included the following components:

- Document Review
- Data Review
- Site Inspection

- Five-Year Review Report development and review

3.6.1 Document Review

This Five-Year Review consisted of a review of relevant documents for OU2 including the ROD and Remedial Design, and applicable federal and state statutes. The source of ARARs for groundwater cleanup at OU2 was also reviewed for changes to the applicable groundwater cleanup standards.

3.6.2 Data Review

Source removal has been implemented but not been completed at Sites 12, 27, or 30. Soil excavation for CERCLA contaminants originally planned for Site 11 will not be conducted due to the discovery of ACM. Finding of ACM as a CERCLA contaminant and the change in the remedy selected in the ROD will be addressed in a Proposed Plan and ROD Amendment. Groundwater monitoring is pending approval of the UFP-SAP and Remedial Action Work Plan.

3.6.3 Site Inspection and Interviews

LUC inspections were conducted annually at OU2 during the period under review. The inspections noted no problematic observations. Copies of the annual certifications are provided in Appendix C.

3.6.4 Site Inspection and Interviews

Inspections at the site were conducted on May 3, 2012 by Tetra Tech and NAS Pensacola personnel. The purpose of the inspection was to assess the protectiveness of the remedy and condition of the monitoring wells.

Institutional controls that are in place include the restriction of land use, restriction of all groundwater use, prohibition of the excavation of areas with soils containing COCs without prior approval from the NAS Pensacola Environmental Office, prevent occupational exposure to COCs in groundwater in the underlying aquifer by requiring use of PPE and monitoring equipment for excavations that may encounter groundwater, and maintenance of all existing or future monitoring and on-site remedy components. At the time of the inspection, institutional controls were found to be adequate, and use of groundwater was not observed. Roadways within OU2 appeared adequate, and there were no apparent signs of vandalism or trespassing. Existing monitoring wells were accessible and in good condition. During a separate regulatory site visit in 2011, several OU2 monitoring wells were observed to be unlocked or in disrepair. Following the site visit, the Navy completed an immediate inspection of all OU2 monitoring wells and document the security of each of the monitoring wells. Deficiencies were not observed during the site inspection.

An interview was conducted with Greg Campbell, Environmental Engineer for NAS Pensacola, on May 2, 2012. According to the interview, Mr. Campbell indicated he is well informed about the Sites that comprise OU2, the individual activities, and progress, and he was not aware of any community concerns regarding the site or its operation or of any incidents such as vandalism, trespassing or emergency responses at the site. The interview and inspection forms are presented in Appendix C.

Mr. Campbell indicated annual LUC inspections are performed. In addition, complaints, violations, or other incidents related to the site requiring a response by his office have not occurred.

3.6.5 ARAR Level Changes

The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Florida Groundwater Classes, Standard and Exemptions Chapter 62-520, F.A.C.
- Surface Water Quality Standards Chapter 62- 302.530, F.A.C.
- Drinking Water Standards, Monitoring, and Reporting Chapter 62-550.310(4)(b), F.A.C.
- Contaminant Cleanup Target Levels Chapter 62- 777.170(1)(a), (1)(b), and (2)(a), F.A.C. in Tables 1 and 2.

There were no changes in these requirements that affect the protectiveness of the remedy. The cleanup goals on Table 2-33 of the ROD were compared to the SCTLs for soils per Chapter 62-777, F.A.C.; CTLs for groundwater per Federal Safe Drinking Water Act, Chapter 62-550, F.A.C.; Chapter 62-777, F.A.C.; and Marine Surface Water Cleanup Target Level (MSWCTLs) for surface water and the discharge of surface water to groundwater per Chapter 62-777, F.A.C. and to the Class III Marine Water values per Chapter 62-302, F.A.C. The following differences were noted:

For cadmium, the value for the MSWCTL on Table 2-33 is listed as 9.3 µg/L, but the current version of Table 1 in Chapter 62-777, F.A.C. refers to Chapter 62-302, F.A.C. which gives a value of 8.8 µg/L. This slight difference would not affect the protectiveness of the remedy.

For dieldrin, the SCTL for leachability to groundwater on Table 2-33 is listed as 2 milligrams per kilogram (mg/kg); however, the current version of Table 2 in Chapter 62-777, F.A.C. gives a value of 0.002 mg/kg. The Remedial Design was reviewed, and the correct value of 0.002 mg/kg was used in the design. Therefore, this does not affect the protectiveness of the remedy.

For zinc, the leachability to groundwater SCTL on Table 2-33 is listed as 6,000 mg/kg; however, the current version of Table 2 in Chapter 62-777, F.A.C. notes that the leachability to groundwater value may be derived using the Synthetic Precipitation Leaching Procedure (SPLP) Test to calculate a site-specific SCTL. The FS was based on the 6,000 mg/kg value and no site-specific value was calculated. Because zinc was not identified as a COC in groundwater, it is unlikely that zinc is migrating from the soil at sufficient concentrations to adversely affect the groundwater. Therefore, this does not affect the protectiveness of the remedy.

There were no location-specific ARARs for this remedy.

The following standards were identified as action-specific ARARs for OU2:

- RCRA Identification of Hazardous Waste (40 CFR 261.11 and 264.13(a)(1))
- RCRA Land Disposal Restrictions (LDRs)(40 CFR 268.49)
- Florida General Pollutant Emission Limitation Standards Chapter 62-296.320, F.A.C.
- Florida Water Well Permitting and Construction Requirements Chapter 62-532.500, F.A.C.
- Florida Hazardous Waste – Requirements for Remedial Action Chapter 62-730.225 (3), F.A.C.
- Florida Natural Attenuation with Monitoring Regulation Chapter 62-780.690(8)(a) thru (c), F.A.C.

The soil removal component of the remedy has been implemented, but not been completed so construction completion reports or similar documents are not available for review. Thus, compliance with RCRA, Florida General Pollution, Florida Well Permitting, and Florida Hazardous Waste regulations cannot be evaluated.

The LTM Plan was included in the Remedial Design and was prepared according to Florida Natural Attenuation with Monitoring Regulation Chapter 62-780.690(8)(a) thru (c), F.A.C.

The sections covering General Provisions for Water Well Permitting and Construction and Abandonment of Water Wells in 62-532, F.A.C. were repealed October 7, 2010. Monitoring well installation and abandonment are now addressed in the FDEP Monitoring Well Design and Construction Guidance Manual, 2008.

3.7 TECHNICAL ASSESSMENT

3.7.1 Question A: Is the remedy functioning as intended by the ROD?

The remedy at Site 11 has been changed due to the discovery of ACM. Soil cover will be used in place of contaminated soil excavation. LTM for groundwater has not yet been implemented. LUCs are in place and appear to be adequate based on the site inspection.

The remedy at Site 12 has been partially implemented. Contaminated soil excavation for radiological constituents occurred during 2010 and 2011. Excavation at Site 12F is on hold until confirmatory soil sampling results are evaluated by RASO and cleared for additional non-radiological soil removals. LTM for groundwater has not yet been implemented. LUCs are in place and are adequate based on site inspection.

Contaminated soil excavation has been completed in unpaved areas at Site 25. LTM for groundwater has not yet been implemented. LUCs are in place and appear to be adequate based on site inspection.

No contaminated soil excavation was required at Site 26. LTM for groundwater has not yet been implemented. LUCs are in place and appear to be adequate based on site inspection.

The remedy at Site 27 has been partially implemented. Contaminated soil excavation has been completed in unpaved areas. Additional soil removal to remediate radiological contamination is dependent on results of RASO investigations, which are ongoing as of June 2012. LTM for groundwater has not yet been implemented. LUCs are in place and appear to be adequate based on site inspection.

RASO completed a RAD survey for Site 30 in 2011. Soil excavation will be completed after RASO investigation results are evaluated for presence of radiological constituents. LTM for groundwater has not yet been implemented. LUCs are in place and appear to be adequate based on site inspection.

Remedial Action Performance: Once fully implemented, the remedy is expected to perform as designed.

Early Indicators of Potential Remedy Failure: None, the source of the contaminants has been removed and natural attenuation monitoring is to be conducted.

Implementation of Institutional Controls and Other Measures: The Remedial Design was approved by the USEPA in August 2009. Based on the site inspection performed on May 3, 2012, institutional controls have been implemented and are adequate for the site.

The reporting and certification requirements for the LUCs are incorporated into the Land Use Control Assurance Plan (LUCAP) between the Navy, USEPA, and FDEP. OU2 will be available for industrial use, while residential use of the site is prohibited. The Navy performs periodic site inspections to ensure LUCs are properly maintained and administered. Groundwater use is prohibited within OU2. The Navy conducts annual reviews of the institutional controls to certify whether the LUCs should remain in place or be modified to reflect a change in site conditions.

Part of the remedy described in the ROD (2008) includes a Groundwater/Surface Water Interface (GSI) investigation. The purpose of the GSI investigation is to assess whether Sites 11 or 30 are exerting an adverse impact on surface water in the wetlands downgradient of these two sites. As per the ROD, the GSI will be completed in two phases. Phase I will be an investigation of groundwater contamination at Sites 11 and 30 and installation of nested monitoring wells. Based on Phase I results, the Phase II GSI will be conducted in areas of groundwater discharge into the wetlands. The information gained from this GSI investigation may be used to optimize the extent of the areas which would require LUCs and provide additional information on the selected remedial alternative. The UFP-SAP for the GSI is currently under regulatory review.

3.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure Assumptions: There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes to Standards and To Be Considered: The ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes to standards since the remedy was implemented. The cleanup goals in the ROD were compared to the current SCTLs for soil, CTLs for groundwater, and MSWCTLs for surface water and groundwater discharging to surface water. No changes in the standards were identified; however, as noted above, several differences were noted. These differences do not affect the protectiveness of the remedy.

Because the soil remedial action is not complete, the action-specific ARARs that relate to the soil remediation component could not be evaluated. The LTM Plan was prepared according to the action-specific ARAR for LTM Plans.

Changes in Exposure Pathways: No changes in the site conditions or land use that affect exposure pathways were identified as part of the five-year review. Exposure to the site groundwater is still restricted by the LUCs.

Changes in Toxicity and Other Contaminant Characteristics: There have been no changes in human health toxicity criteria that would impact protectiveness of the remedy.

Changes in Risk Assessment Methodologies: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

3.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that would call into question the protectiveness of the remedy.

3.8 ISSUES

Issues were discovered during the Five-Year Review and are noted in Table 3-4.

TABLE 3-4
OU2 ISSUES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Issues	Affects Protectiveness (Y/N)	
	Current	Future
The remedy is not fully implanted. Once the remedy is implemented as intended in the ROD and ROD Amendment, the remedy will be protective for the long term. The remedy is protective in the short term as LUCs are being implemented.	N	Y

3.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

An ROD amendment is necessary to address the change in remedy at Site 11 and excavation of radiological contaminated soils at Sites 12, 27, and 30.

3.10 PROTECTIVENESS STATEMENT

The remedy is expected to be protective of human health and the environment upon installation of a soil cover at Site 11; completion of excavation and off-site disposal of contaminated soil at Sites 12, 27, and 30; and implementation of groundwater monitoring at all sites. LUCs have been implemented at all sites and will limit exposure to contaminated soil and groundwater at Sites 11, 12, 27, and 30. The remedy is protective for the short term as LUCs continue to be implemented.

4.0 OPERABLE UNIT 3

The OU3 “No Action” ROD was signed on September 30, 2005. This Five-Year Review consists of an approximate five-year period of data and provides a status update for OU3, Site 2 – Waterfront Sediments.

This statutory review is required by regulation because contamination remains on site and does not allow for UU and UE.

4.1 SITE CHRONOLOGY

A list of important OU3 historical events and relevant dates in the site chronology is shown in Table 4-1.

TABLE 4-1
OU3 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Numerous investigations conducted in and around the Pensacola Bay System to monitor the ecological health of the bay and determine the impact of commercial, industrial, and municipal activities.	Early 1950’s
Early environmental studies of Site 2 were conducted under the direction of the Navy Assessment and Control of Installation Pollutants Department (NEESA, 1983). Sediment samples collected and analyzed using Extraction Procedure toxicity methods showed elevated concentrations of lead and chromium.	1983
Thompson Engineering and Testing, Inc. sediments study in the area of Site 2 showed grain-size variation from sandy silt/clayey silt with sand on the northeastern side of the turning basin, to fine sands/fine sands with silts on the southwestern side.	1984
Geraghty and Miller, Inc. conducted a verification and characterization study at Site 2. Six samples were collected approximately 300 feet offshore from the storm-sewer outfalls, in about 30 feet of water.	1984
The Navy conducted an environmental impact statement study.	1986
Collard (EnSafe, 2005b) summarized the environmental-biological history of the Pensacola Bay System, documenting published as well as previously unpublished data from numerous studies conducted from the 1950s to the present.	1991
EnSafe Inc. conducted a thorough RI of Site 2	1996
FS completed	1997
EnSafe Inc. RI Addendum of Site 2	2004
ROD issued	2005

4.2 BACKGROUND

4.2.1 Physical Characteristics of OU3

Operable Unit 3 (Site 2) is on the southeastern shoreline of NAS Pensacola, along the Pensacola Bay waterfront, as shown on Figure 4-1. This site is an approximate 1,800-foot by 1,400-foot area of nearshore sediments along the southeast waterfront area, where numerous active storm water and inactive industrial waste sewer outfalls exist. All industrial waste outfalls have been inactive since 1973. The southeast waterfront is dominated by a protective concrete seawall with several seaplane ramps, and is adjacent to a large paved parking apron. The approximate 3- to 4-foot high seawall rests on a concrete platform. Fifty-six outfalls, ranging in diameter from 1 inch to 42 inches, were previously identified along the seawall (E&E, 1991). The seawall also contains numerous scuppers to drain surface water runoff from the adjacent parking areas.

In the past, many of the outfalls discharged untreated industrial wastes into Pensacola Bay. This occurred from 1939 to 1973, after which NAS Pensacola's industrial waste-stream was diverted to the IWTP. Contaminants that sorbed to sediments potentially posed excess unacceptable risk to the benthic community and the predatory animals feeding upon it.

Surface soil at NAS Pensacola is primarily highly permeable sands, which limit stream formation. Several naturally occurring intermittent streams and numerous man-made drainage ditches flow south into Pensacola Bay, which has a mean depth of 10 feet in the NAS Pensacola area. The depth to groundwater at NAS Pensacola ranges from less than 1 foot to approximately 20 feet bls, depending on land surface elevation and proximity to surface water bodies.

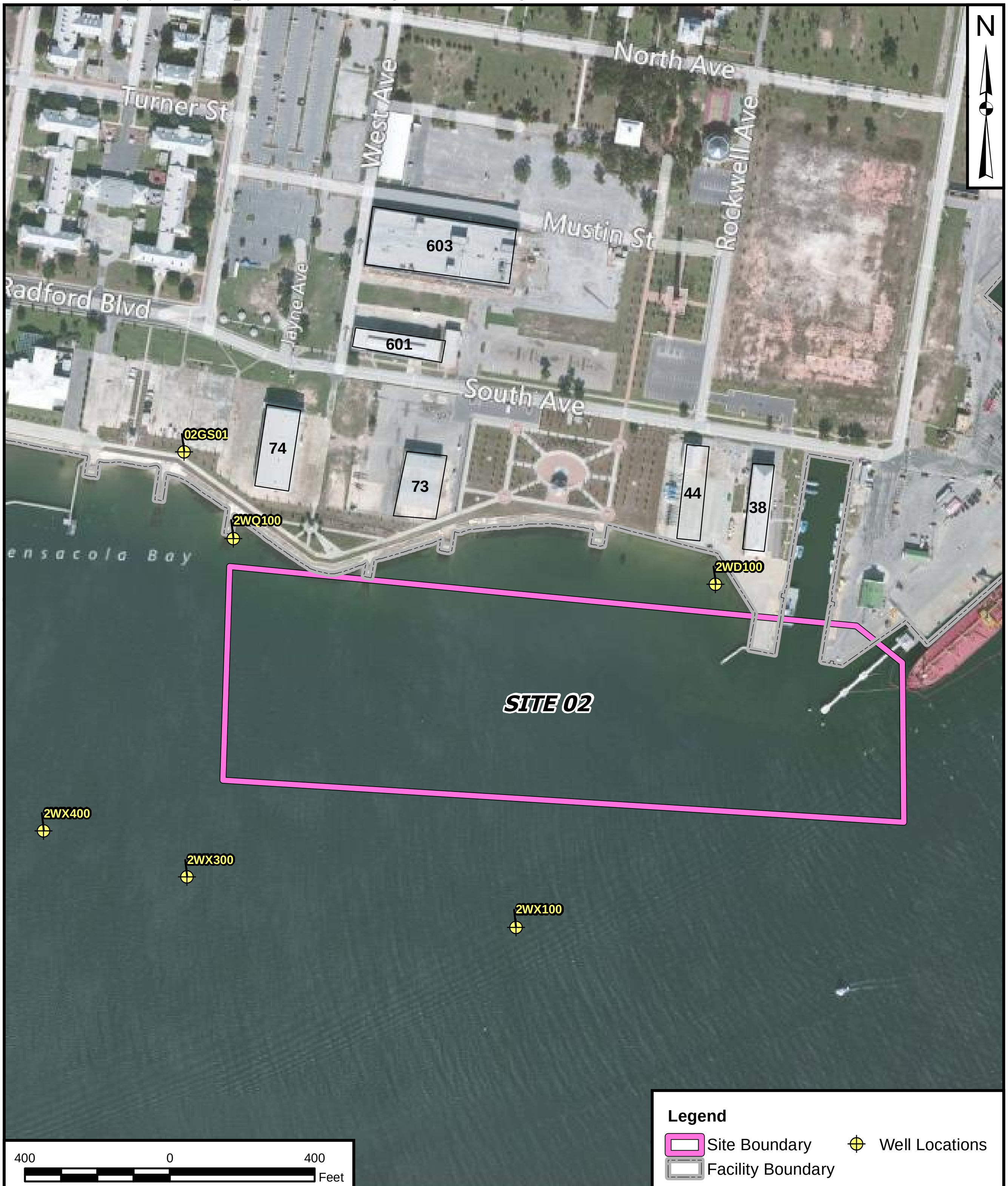
4.2.2 Land and Resource Use at OU3

Boat maintenance, refueling services, surface water runoff, routine application of pesticides draining to the Site 2 area, and off-site bay activities (e.g., boat traffic, non-point source sediment drift) will continue to occur in the Pensacola Bay area near the NAS Pensacola shoreline.

Future land use at NAS Pensacola is expected to remain military oriented and under the control of the Navy.

Groundwater is not currently used as a potable water source at NAS Pensacola. The main source of potable water for NAS Pensacola is the Navy-owned well field located at Naval Technical Training Center (NTTC) Corry Station, which is located approximately three miles north of NAS Pensacola on the northern (opposite) side of Bayou Grande.

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU3Site2.mxd [alex.montalvo 6/5/2012]



DRAWN BY GIS	DATE 6/5/2012	CONTRACT NUMBER 112G00702	CTO NUMBER 067
CHECKED BY A.I.	DATE 6/5/2012	APPROVED BY	DATE
REVISED BY	DATE	APPROVED BY	DATE
SCALE AS NOTED		FIGURE NO. 4 - 1	REV 0

NAVFAC

SITE MAP - OPERABLE UNIT 3
5 YEAR REVIEW
NAS PENSACOLA
PENSACOLA, FLORIDA

4.3 HISTORY OF CONTAMINATION AT OU3

From 1939 to 1973, untreated industrial wastes from NADEP and Naval Air Rework Facilities were discharged into the Pensacola Bay System at Site 2. During that 34-year time span, an estimated 83 million gallons of the following materials were disposed into the bay: waste-containing paint, paint solvents, thinners, ketones, trichloroethylene, Alodine®, mercury, and concentrated plating wastes (primarily chromium, cadmium, lead, nickel, and cyanide [Geraghty and Miller, 1984]). All industrial waste outfalls have been inactive since 1973, and the wastes were diverted to the IWTP. Due to the transport mechanism characteristic of Pensacola Bay, it is also possible that off-site sources may have affected the site. In addition, contaminated groundwater from adjacent OU11 Site 38 has discharged into Pensacola Bay in the Site 2 area.

4.3.1 Initial Investigation for OU3

Investigation at Site 3 occurred from 1993 to 1996. Investigations included a Phase I sampling event to determine total organic carbon and grain-size distribution in sediments and a Phase II sampling event to assess contamination. Based on analytical results, “hot spots” were identified and the extent of contamination was delineated. An FS was completed in 1997 to evaluate four remedial alternatives (no action, monitoring, capping, and dredging). Monitoring was selected as the preferred alternative. One public comment was received, requesting a remedial action or nothing be done, rather than monitoring. After deliberation, the USEPA, FDEP, National Oceanic and Atmospheric Administration, and the Navy agreed to perform additional assessment because Hurricane Georges affected the area in the years following the initial sampling event.

A remedial investigation was performed in March 2000 to determine whether chemical constituents at Site 2 create adverse conditions for benthic communities. In the Final RI Report Addendum (EnSafe, 2004), sediment contamination was identified in the southeast portion of Site 2. The estimated volume of contamination, assuming a 1-foot depth, was 1,600 cubic yards. It was recommended in the Final RI Report Addendum that a FS be conducted to determine the most appropriate method for addressing the sediment.

A Focused FS Addendum that evaluated four remedial alternatives (no action, monitoring, capping, and dredging with off-site disposal) for the site was completed in October 2004. This report addresses sediment within the two 150-foot by 150-foot areas identified as having adverse effects in the 2004 RI Addendum. The Proposed Plan for the site stated that no action was the preferred alternative, and a public comment period was held from July 1, 2005 to August 14, 2005. No comments were received from the public on the Proposed Plan.

4.3.2 Basis for No Action at OU3

An RI was conducted to identify the nature and extent of contaminants in surface waters and sediments, and the influence of groundwater, as a result of past disposal practices from the shore-based facilities (EnSafe, 1996b). The Focused FS evaluated the RI, the baseline risk assessment, and the ecological risk assessment to develop preliminary remedial goals (PRGs) for OU3. The baseline risk assessment did not identify any unacceptable risk to human health, and no further action was required to protect human health under the current use. However, it was found that contaminated sediments pose an unacceptable risk to the benthic organisms at OU3.

4.4 REMEDIAL ACTIONS FOR OU3

No action was selected as the preferred remedial action alternative for OU3.

4.4.1 Remedy Selections at OU3

The ROD for NAS Pensacola OU3 was signed on September 30, 2005. Based on the information available at this time, the Navy, USEPA, and FDEP believe the selected remedy will be protective of human health and the environment, comply with ARARs, be cost effective, and use permanent solutions and alternative treatment technologies to the maximum extent practicable.

Six remedial options were considered for OU3:

- No action
- Capping of sediment
- Dredging with site-specific confined disposal facilities
- Dredging with off-site disposal of sediment
- Solidification/stabilization of sediment
- Long-term sediment monitoring

The selected remedy was no action. This remedy poses no risk to current workers and site trespassers, and no additional risk to the ecosystem. The expected outcomes of the selected remedy are as follows:

- The Navy will retain the use of OU3, which will be consistent with the current and expected military use of the area. Homeland security restrictions prohibit unauthorized access.

- Natural sedimentation should be occurring in the area of concern and eventually bury the contaminated sediment.

- Sediments are also expected to continue to be remediated through natural attenuation, which should reduce current contaminants to below remedial goals.

- Sediments would remain in place, eliminating the risk of releasing sediment-bound contaminants into the water column, and contaminants infiltrating from groundwater may be prevented from entering the surface water as heavily reduced sediments are typically capable of removing inorganic and organic compounds through binding and reductive processes.

4.4.2 Remedy Implementation at OU3

No action was selected as the preferred remedial action alternative for OU3; therefore, no implementation was necessary.

4.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

4.5.1 Protectiveness Statements from the Last Review

OU3 was not included in the previous Five-Year Review and no action was selected as the preferred remedial action alternative for OU3; therefore, no protectiveness statements exist from the last review.

4.5.2 Status of Recommendations and Follow-up Actions from Last Review

No action was selected as the preferred remedial action alternative for OU3; therefore, no status of recommendations and follow-up actions exist from the last review.

4.6 FIVE-YEAR REVIEW PROCESS

4.6.1 Document Review

Several documents including the RI/FS and ROD and applicable federal and state statutes were reviewed during this Five-Year Review.

4.6.2 Data Review

No remedial actions or monitoring has occurred since the last Five-Year Review.

4.6.3 Site Inspection and Interviews

No action was selected as the preferred remedial action alternative for OU3; therefore, no site inspections or interviews were conducted.

4.6.4 ARAR Level Changes

Because the ROD for OU3 is for No Action, there are no ARARs. Therefore, there were no ARARs to evaluate.

4.7 TECHNICAL ASSESSMENT

4.7.1 Question A: Is the remedy functioning as intended by the ROD?

No action was the selected remedy.

4.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

No action was the selected remedy.

4.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No issues have come to light that would call into question the no action remedy.

4.8 ISSUES

No issues were discovered during the Five-Year Review.

4.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

There are no recommendations or follow-up actions for OU3.

4.10 PROTECTIVENESS STATEMENT

The remedy for OU3 is protective of human health and the environment.

5.0 OPERABLE UNIT 4

The OU4 ROD was signed on by the Navy on November 30, 1999. Implementation of the remedial actions at OU4 began in 2001. This Five-Year Review consists of an approximate five-year period of data and provides a status update for OU4, Site 15 – Area Pesticide Rinsate Disposal.

This Five-Year Review for OU4 is being conducted because contaminated wastes are still contained on site and do not allow for unlimited use and unrestricted exposure.

5.1 SITE CHRONOLOGY FOR OU4

A list of important OU4 historical events and relevant dates in the site chronology is shown in Table 5-1.

TABLE 5-1
OU4 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Fertilizer, Herbicides and Pesticides Stored and Mixed at Golf Course Maintenance Facility	1963 - Present
Verification Study conducted	1984
Characterization Study conducted	1986
Contamination Assessment/RI – Phase I conducted	1991
UST removed from Facility	1993
Contamination Assessment/RI – Phase II conducted	1995
Contamination Assessment/RI – Phase III conducted	1996
Baseline Risk Assessment conducted	1997
ROD issued	September 27, 2000
Baseline Sampling Event	November – December 2001
Initial Remedial Action Conducted – 754 cubic yards of soil removed/disposed.	April 26, 2002 – May 6, 2002
1st Semiannual Monitoring Event	June 2002
2nd Semiannual Monitoring Event	January 2003
Groundwater Monitoring Plan	June 25, 2003
Annual Monitoring Report	January 18, 2005
Semiannual Monitoring Report	August 2005
Semiannual Monitoring Report	November 11, 2005

TABLE 5-1
OU4 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Annual Monitoring Report	December 22, 2005
Semiannual Monitoring Report	March 15, 2006
Annual Monitoring Report	November 6, 2006
Semiannual Monitoring Report – Year 2007	January 2008
Semiannual Monitoring Report	April 2008
Semiannual Monitoring Report	September 2008
Semiannual Monitoring Report	November 2008
Semiannual Monitoring Report	September 2009
Year 2009 first Semiannual Groundwater Monitoring Report	April 2010
Year 2010 Semiannual Groundwater Monitoring Report	June 2010
Year 2010 Semiannual Groundwater Monitoring Report	December 2010
Year 2011 Semiannual Groundwater Monitoring Report	July 2011
Year 2011 Semiannual Groundwater Monitoring Report	February 2012
Year 2012 Annual Groundwater Monitoring Report	June 2012

5.2 BACKGROUND

5.2.1 <u>Physical Characteristics of OU4</u>

OU4, Site 15, is located in the northern portion of NAS Pensacola, as shown on Figure 1-2. Site 15 is accessible from the west by an unpaved road and includes portions of the golf course, the golf course maintenance facilities, three concrete wash-down pads, two asphalt wash-down pads, a former pesticide/drum storage building, a removed UST, equipment storage buildings, and several in-use buildings. The site is surrounded by the golf course on its southern and western sides and Bayou Grande approximately 665 feet to the north.

From 1963 to the present, fertilizer, pesticide, and herbicide materials for application at the golf course have been stored and mixed at the golf course maintenance facility. Application equipment such as tractors, sprayer tanks, and spreaders are also rinsed at the facility's wash-down pads, which are located northeast of Building 2692 and northwest of Building 3447. Prior to the construction of the wash racks, cleaning the equipment at the asphalt wash-down pad released dilute rinsate solutions directly onto the surrounding ground surface, where the materials infiltrated the soil (Geraghty and Miller, 1984).

In the past, a sink located outside of Building 3586 and a floor drain in a concrete pad north of the building collected pesticide and herbicide residue wastes and discharged them into a UST. The contents were periodically pumped out by a contracted agent before its removal in 1993. The UST was removed in 1993 and the contents of the tank were spread across the ground surface, approximately 200 feet north-northwest of Building 3447 (EnSafe, 1999).

5.2.2 Land and Resource Use at OU4

Site 15 is located within the confines of the NAS Pensacola Golf Course. Surface cover in the vicinity of the site is dirt and/or grass (See Figure 5-1). The site is separated from the golf course by a perimeter border of oak and palm trees. Water hazards associated with the golf course are located 765 feet to the northeast and 425 west from the central part of the site. Bayou Grande is located approximately 665 feet north of the central part of the study area.

Depth to groundwater ranges from 10 to 15 feet bls, depending on precipitation, tidal influence, and ground surface elevation. Storm water management on the site is addressed through direct infiltration into the subsurface through the sandy surficial soil (EnSafe, 1997b).

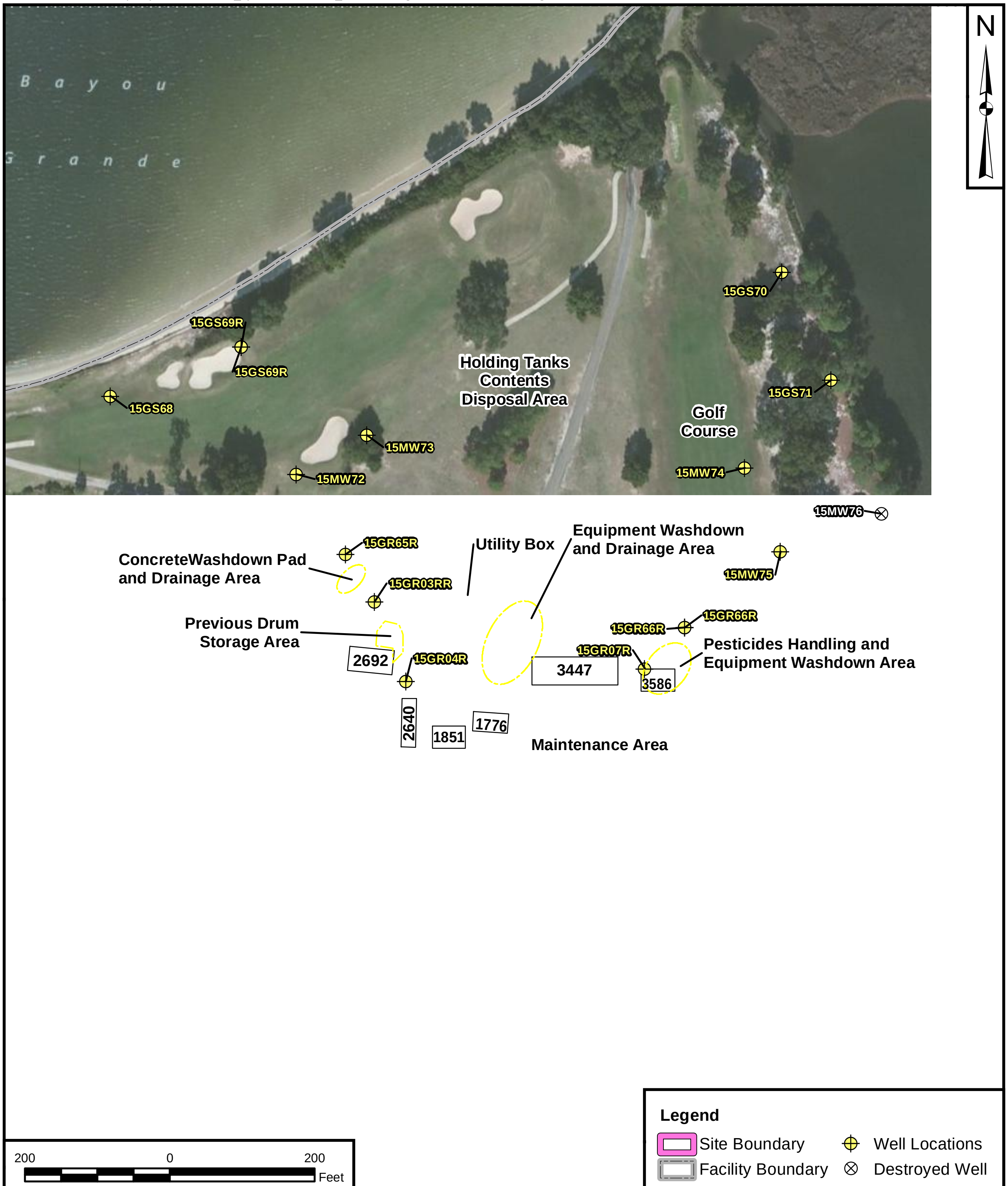
Groundwater flow generally mimics the peninsular topography (with flow to the northwest, north, and northeast towards Bayou Grande). Groundwater is not currently used as a potable water source at OU4 (CH2M Hill, 2006). The main source of potable water for NAS Pensacola is the Navy-owned well field located at NTTC Corry Station, which is located approximately three miles north of NAS Pensacola on the northern (opposite) side of Bayou Grande.

5.3 HISTORY OF CONTAMINATION AT OU4

Contaminant types identified in soil samples collected at OU4 consisted of metals (particularly arsenic), total recoverable petroleum hydrocarbons (TRPH), VOCs, polynuclear aromatic hydrocarbons (PAHs), and pesticides. Low concentrations of metals (particularly arsenic) and dieldrin/4,4-dichlorodiphenyldichloroethylene (DDE) were detected in groundwater samples (EnSafe, 1999).

Several inorganic and organic parameters exceeded preliminary remedial goals in soil samples. Based on the magnitude and frequency of the detection, arsenic and dieldrin remained the primary COCs in soil. Arsenic was detected across the extent of the site due to handling of various arsenic-based herbicides and pesticides, such as the common herbicide monosodium methanarsonate. The two areas of greatest surface soil arsenic concentrations were identified as the asphalt pad northwest of Building 2640 and the concrete pad west-northwest of Building 3586. Contaminated soil was also noted at isolated locations throughout Site 15 and north of the road in the old disposal area (EnSafe, 1999).

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU4_Site15.mxd [alex.montalvo 7/13/2012]



DRAWN BY	DATE
GIS	7/13/2012
CHECKED BY	DATE
A.I.	7/13/2012
REVISED BY	DATE
SCALE AS NOTED	

NAVFAC

SITE MAP - OPERABLE UNIT 4
5 YEAR REVIEW
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NUMBER	CTO NUMBER
112G00702	067
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. 5 - 1	REV 0

5.3.1 Initial Investigation for OU4

The IAS report prepared by NEESA identified OU4, Site 15 as potentially posing a threat to human health or the environment due to contamination from past hazardous materials operations. According to the IAS report, pesticide rinsate was not sufficiently concentrated to threaten human health or the environment and further study was not recommended (NEESA, 1983). Therefore, environmental sampling and laboratory analyses were not performed, and the potential impact was not properly assessed.

In 1984, Geraghty and Miller, Inc. conducted a Verification Study of the asphalt wash-down pad and pesticide storage area at OU4, Site 15. The results of the Verification Study confirmed the presence of arsenic and organic pesticide contaminants in the soil. The presence of arsenic impacted groundwater at the site was documented by Geraghty and Miller during performance of a 1986 Characterization Study.

Phase I of a Contamination Assessment/RI was conducted in 1991 by Ecology and Environment, Inc. to identify principal areas and primary COCs, and to recommend if subsequent investigations were necessary. Investigation results indicated the presence of metals (particularly arsenic), TRPH, VOCs, PAHs, and pesticides in the soil. Low concentrations of metals (particularly arsenic) and pesticides (dieldrin/4,4-DDE) were detected in groundwater samples (EnSafe, 1999).

5.3.2 Basis for Taking Action at OU4

The hazard presented by potential exposure to the identified contaminants at Site 15 resulted in the performance of a baseline risk assessment. The baseline risk assessment used the Florida risk threshold goals, which is more conservative than USEPA's acceptable risk range and associated Risk Assessment Guidance for Superfund information (EnSafe, 1997b).

The Incremental Lifetime Cancer Risk (ILCR) associated with the incidental ingestion of surface soil by a hypothetical future resident (7E-5) and site worker (8E-6) exceeded the Florida target risk level of 1.0E-6. The ILCR associated with dermal contact with surface soil by a hypothetical future resident (2E-5) and site worker (7E-6) also exceeded the Florida target risk level. Both exceedances were primarily due to the presence of arsenic at 24 sample locations, dieldrin in two of the locations, and alpha-chlordane and BEQs in one location each. In addition, the ILCR associated with the incidental ingestion of groundwater by a hypothetical future resident in Areas 1 and 2 (5E-3 and 2E-3, respectively) and site workers (1E-3 and 5E-4, respectively) exceeded FDEP's target risk level. This was primarily due to the presence of arsenic (CH2M Hill, 2006).

The HHRA identified arsenic, BEQs, dieldrin, alpha-chlordane, and gamma-chlordane as COCs for surface soil, and arsenic and dieldrin as COCs for groundwater. The HHRA determined that 15 soil samples had a cumulative non-cancer hazard index (HI) from potential exposures to alpha-chlordane, arsenic, BEQs, dieldrin, and gamma-chlordane in soil of less than 1. This is within the USEPA and FDEP target HI of 1 for current workers, trespassers, and future residents for industrial scenarios. Moreover, the HHRA determined that groundwater samples from 6 of 28 monitoring well locations had dieldrin or arsenic at concentrations which resulted in a cumulative HI of greater than 1, primarily due to the presence of arsenic. This is not within the USEPA and FDEP acceptable risk range for current workers, trespassers, and future residents. The HHRA determined all 15 soil samples had a cumulative non-cancer HI from potential exposures to alpha-chlordane, arsenic, BEQs, dieldrin, and gamma-chlordane in soil of less than 1. This is less than the USEPA and FDEP target HI of 1 for current workers, trespassers, and future residents for industrial scenarios.

The ecological risk assessment selected the eastern cottontail rabbit and the American robin as endpoint wildlife species for the baseline risk assessments ecological component, as no endangered species were identified on site. Based on conservative assumptions, the risk evaluation indicates potential sub-lethal effects to these species from maximum detected concentrations of arsenic, mercury, and possibly pesticides in surface soil (EnSafe, 1999).

“Down-gradient surface water, sediment, and biota (within Bayou Grande and Wetland 65) were not at risk from the site, given their distance, the shallow groundwater quality adjacent to the water bodies, and the nature and limited extent of site-impacted groundwater (EnSafe, 1999).”

Contaminants

COCs related to each medium are presented in Table 5-2.

TABLE 5-2
OU4 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Medium	Contaminants of Concern
Soil	Arsenic, BEQs, and dieldrin
Groundwater	Arsenic and dieldrin

5.4 REMEDIAL ACTIONS

5.4.1 Remedy Selections at OU4

The ROD for NAS Pensacola OU4 was signed on November 30, 1999. RAOs were developed based on data collected during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD.

The purpose of the remedial action at OU4 was to reduce the unacceptable risks to human health and environment associated with exposure to the COCs in soil and groundwater. To meet these goals, two RAOs were identified. Table 5-3 lists the RAOs for OU4.

**TABLE 5-3
OU4 REMEDIAL ACTION OBJECTIVES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA**

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Soil	Arsenic, BEQs, and dieldrin	Eliminate human health risk above HI=1.
Groundwater	Arsenic and dieldrin	Monitor groundwater to ensure COCs are not migrating off-site and institutional controls

The remedial alternative for soil was selected to prevent future unacceptable risk due to exposure to arsenic, BEQ, and dieldrin contaminated soil. The major components of the soil remedy include:

- Removing excess risk from the dermal and ingestion pathways for contaminated soil by removing contaminated soil above industrial goals through a removal action.
- Implementing institutional controls through the LUCAP, restricting site use to industrial.
- Reviewing the institutional controls and certification in order to determine if they should remain in place or be modified to reflect changing site conditions.

The following components constitute the remedial action for OU4 to address the groundwater RAOs:

- Perform groundwater monitoring to ensure COCs are not moving off-site. Monitoring slated to cease after two consecutive sampling events demonstrate attainment of remedial goals, and concurrence with USEPA and FDEP.

- Conducting a review to determine whether groundwater performance standards continue to be appropriate.

- Implementing institutional controls through the LUCAP to restrict use of groundwater from the surficial zone of the sand and gravel aquifer within 300 feet of the site.

- Annual review/certification of institutional controls to determine if they should remain in place or be modified to reflect changing site conditions.

5.4.2 Remedy Implementation at OU4

Source removal activities were completed between April 26, 2002 and May 6, 2002. Five individual contaminated areas were consolidated into three excavation areas. A registered Florida land surveyor demarked the areas requiring excavation to a depth of 2 feet bls and two specific areas requiring excavation to the soil water table interface. Demarked excavation areas were based on assessment data provided by CH2M Hill.

Approximately 754 cubic yards of arsenic impacted soil was excavated and transported to the BFI Timberlands Landfill, located in Brewton, Alabama, for disposal. Prior to completion of excavation activities, representative soil samples were collected from the selected off-site backfill source at the Sand & Dirt, Inc. facility. The soil was analyzed to ensure suitability for use at the site. One sample was collected from the proposed backfill borrow pit and analyzed for VOCs, SVOCs, pesticides, herbicides, metals, PCBs, TRPH, and pH. The analytical results indicated that with the exception of metals, the targeted parameters were not detected in the sample collected from the proposed backfill borrow pit. Arsenic was detected above the residential direct exposure SCTL, but below the site-specific cleanup goal of 21.93 mg/kg. Therefore the backfill was accepted as “clean fill” (CH2M Hill, 2006).

The ROD for Site 15 requires monitoring of groundwater to ensure that COCs are not moving off-site. The remedial goal for arsenic, established in the Site 15 ROD, is 50 µg/L. Baseline groundwater sampling was conducted in November and December 2001, and two semiannual sampling events were completed in June 2002 and January 2003. In preparation of LTM, the monitoring wells at Site 15 were evaluated to document construction deficiencies. As a result, 14 monitoring wells that were damaged or improperly constructed were abandoned. Five were replaced (15GR03R, 15GR04R, 15GR65R, 15GR66R, and 15GS69R), and one new monitoring well (15GR07R) was installed adjacent to a previously abandoned monitoring well (CH2M Hill, 2003).

5.4.3 System Operation/O&M at OU4

The cost for the selected remedy does not include O&M.

5.4.4 Long-Term Groundwater Monitoring at OU4

The ROD specifies collection of groundwater samples from monitoring wells 15GR03R, 15GR04R, 15GR07R, 15GR065R, 15GR66R, 15GS68, 15GS69R, 15GS70, 15GS71, 15MW72, 15MW73, 15MW74, 15MW75, and 15MW76 on a semiannual basis. The results of the baseline groundwater monitoring event conducted in November through December 2001 indicated the presence of arsenic at concentrations ranging from 70 µg/L to 510 µg/L. The arsenic concentrations detected during the June 2002 and January 2003 semiannual sampling events ranged from 66 µg/L to 650 µg/L, and 53 µg/L to 630 µg/L, respectively. Arsenic concentrations detected in groundwater samples collected semiannually from January 2004 to October 2007 ranged from non-detect to 160 µg/L. However, the monitoring well with the highest previous concentrations (15GR03R) has not been sampled since March 2006 because the well could not be located (Aerostar, 2008a). Aerostar installed a replacement monitoring well, 15GR03RR.

Trend analysis for the COCs for groundwater at NAS Pensacola was performed using the Mann-Kendall test (ProUCL Version 4.1.00 [Lockheed Martin Environmental Services, 2010]) at a 95 percent confidence level and OU4 groundwater sample data collected from 2004 to 2011 (Appendix D).

The concentration of arsenic at monitoring well location 15GR03RR since September 2008 has raged from 65 to 870 µg/L and exceed the remedial goal for arsenic of 50 µg/L, established in the Site 15 ROD and the current federal and state MCL of 10 µg/L. The Mann-Kendall trend analysis suggest no trend is present at a 95 percent confidence level.

The concentration of arsenic at monitoring well location 15GR04R, which has been sampled 10 times since September 2008, has raged from 4.8 to 20 µg/L and did not exceed the remedial goal for arsenic of 50 µg/L, but exceeded the current federal and state MCL of 10 µg/L in 6 of the 10 groundwater samples. This monitoring well has not been sampled since March 2010. The Mann-Kendall trend analysis suggests no trend is present at a 95 percent confidence level.

The concentration of arsenic at monitoring well location 15GR65R, which has been sampled 15 times since September 2008, has raged from less than 3.0 µg/L to 14 µg/L and did not exceed the remedial goal for arsenic of 50 µg/L, but exceeded the current federal and state MCL of 10 µg/L in 4 of the 15 groundwater samples. The Mann-Kendall trend analysis suggest no trend is present at a 95 percent confidence level.

The concentration of arsenic at monitoring well location 15GR66R, which has been sampled 15 times since September 2008, has raged from 10 to 38 µg/L and did not exceed the remedial goal for arsenic of 50 µg/L, but equaled or exceeded the current federal and state MCL of 10 µg/L in each of the 15 groundwater samples. The Mann-Kendall trend analysis suggest a downward trend is present at a 95 percent confidence level.

Since March 2008, arsenic has been detected only one time at monitoring well location 15GS70 at a concentration that exceeds the current federal and state MCL of 10 µg/L. Also, since March 2008, arsenic has not been detected or was less than the current federal and state MCL of 10 µg/L at nine monitoring well locations (15GR075, 15GS68, 15GS69R, 15GS71, 15MW72, 15MW73, 15MW74, 15MW75, and 15MW76).

Monitoring well locations 15GR075, 15GS68, 15GS69R, 15GS70, 15GS71, 15MW73, and 15MW75 have not been sampled since September 2009. Monitoring well 15MW76 has not been located since March 2005.

The cost expended to date for capital costs, O&M costs, and remedial action is $1,331,021.

5.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

Since the last Five-Year Review, groundwater monitoring has continued at OU4. Additionally, institutional controls remain in place and annual inspections and certifications have been conducted.

An ESD is necessary to address the change the remedial goal of 50 µg/L for arsenic in the OU4 ROD to 10 µg/L.

No issues were identified during the previous Five-Year Review; therefore, there were no follow up actions.

5.5.1 Protectiveness Statements from the Last Review

Based on the results of the 2008 Five-Year Review, the remedy was expected to be protective of human health and the environment upon attainment of groundwater cleanup goals through natural attenuation.

5.5.2 Status of Recommendations and Follow-up Actions from Last Review

No recommendations or follow up actions were identified during the previous Five-Year Review.

5.6 FIVE-YEAR REVIEW PROCESS

This is the second Five-Year Review for OU4. Members of the NAS Pensacola Partnering Team were notified of the initiation of the Five-Year Review in January 2012. The Five-Year Review was led by Gerald Walker of Tetra Tech, the NAVFAC SE Navy CLEAN Contractor, and included other Tetra Tech staff. Patty Marajh-Whittemore of NAVFAC SE, Greg Campbell of NAS Pensacola Public Works Department, Tim Woolheater of USEPA, David Grabka of FDEP, and Sam Naik of CH2M Hill assisted in the review.

The review included the following components:

- Document Review
- Data Review
- Site Inspection
- Five-Year Review Report development and review

5.6.1 Document Review

This Five-Year Review consisted of a review of relevant documents including the ROD, Interim Remedial Action Report, Groundwater Monitoring Plan, semiannual monitoring reports, and applicable federal and state statutes.

5.6.2 Data Review and Review of COC Data for Groundwater

The results presented in the Interim Remedial Action Report indicate that arsenic impacted soil at concentrations greater than the remedial goal were removed and replaced with clean backfill. Graphs developed using the concentrations of arsenic provided from data in monitoring reports summarizes the analytical results of MNA of groundwater; suggesting that arsenic concentrations have decreased. With the exception of monitoring well location 15GR66R, Mann-Kendall trend test suggest that no trend is present at a 95 percent confidence level. Trend analysis results are provided in Appendix D. Review of the March 2012 groundwater analytical data indicates that arsenic concentrations exceeded the ROD specified remedial goal of 50 µg/L and the current federal and state MCL of 10 µg/L at monitoring well location 15GR03RR (110 µg/L). The arsenic concentration at monitoring well 15GR66R (16 µg/L) exceeded the current federal and state MCL of 10 µg/L.

5.6.3 LUC Inspections

LUC inspections were conducted annually at OU4 during the period under review. The inspections noted no problematic observations. Copies of the annual certifications are provided in Appendix E.

5.6.4 Site Inspection and Interviews

An inspection was conducted at the site on May 3, 2012 by Tetra Tech and NAS Pensacola personnel. The purpose of the inspection was to assess the protectiveness of the remedy and condition of the monitoring wells. Because surficial soil with arsenic concentrations exceeding the remedial goal was removed, fencing the site was not warranted. Monitoring wells 15GGR01 and 15MW76 were missing at the time of the inspection and need to be replaced. The remainder of the monitoring wells were accessible and in good condition.

The institutional controls that are in place include the restriction of groundwater use within 300 feet of the site. At the time of the inspection, institutional controls were found to be adequate, and use of groundwater was not observed. Roadways within OU4 appeared adequate, and there were no apparent signs of vandalism or trespassing.

An interview was conducted on May 2, 2012 with Greg Campbell, Environmental Engineer for NAS Pensacola. According to the interview, Mr. Campbell indicated he is well informed about the site's activities and progress, and was not aware of any community concerns regarding the site or its operation, or of any incidents such as vandalism, trespassing or emergency responses at the site. The interview forms are presented in Appendix E.

Mr. Campbell indicated annual LUC inspections are performed. In addition, complaints, violations, or other incidents related to the site requiring a response by his office have not occurred. Future construction of a warehouse is planned for the site.

5.6.5 ARAR Level Changes

The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Safe Drinking Water Act MCLs (40 CFR 141.11)
- Safe Drinking Water Act MCLGs (40 CFR 141.50 – 141.51)
- Florida GCTLs, Chapter 62-777, F.A.C.
- Florida SCTLs, Chapter 62-777, F.A.C.
- Florida Drinking Water Standards, Monitoring and Reporting, Chapter 62-550, F.A.C.
- Florida Ground Water Classes, Standards, and Exemptions, Chapter 62-520, F.A.C.

Contaminant Cleanup Target Levels, Chapter 62-777, F.A.C. (Amended 4/17/05), Contaminated Site and Cleanup Criteria, Chapter 62-780, F.A.C., and Brownfields Cleanup Criteria, Chapter 62-785, F.A.C. were promulgated after the ROD. These new criteria need to be considered to determine if the remedy is still protective. Chapter 62-777, F.A.C. provides GCTLs for contaminants without MCLs per Chapter 62-550, F.A.C. The CTLs in Chapter 62-777, F.A.C. do not affect the protectiveness of the remedy.

Chapter 62-780, F.A.C. provides rules for the assessment and cleanup of non-petroleum sites with contaminants that have been released or discharged into the environment and Chapter 62-785, F.A.C. provides rules for assessment and cleanup of Brownfields sites. Rules promulgated per Chapter 62-780, F.A.C. and Chapter 62-785, F.A.C. do not affect the protectiveness of the remedy. Since signing the ROD for OU4 on September 27, 2000, changes to federal regulations in 2002 and 2006 and to Florida regulations in 2005 lowered the MCL for arsenic in groundwater from 50 to 10 µg/L. On January 22, 2001, the USEPA adopted a new MCL for arsenic in drinking water at 10 µg/L, replacing the old standard of 50 µg/L. The USEPA rule became effective on February 22, 2002 and became enforceable to water systems on January 23, 2006. Florida's drinking water standards are contained in Chapter 62-550, F.A.C. Florida's primary drinking water standards, which are health based, are described in Rule 62-550.310, F.A.C. Florida changed its MCL for arsenic from 50 µg/L to 10 µg/L on January 1, 2005. This change in the federal and state MCL for arsenic is being implemented in a draft ESD.

There have been no other changes in Safe Drinking Water Act and Chapter 62-550, F.A.C. MCLs that affect the protectiveness of the remedy.

The following standards were identified as location-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Executive Order 11990 Wetlands Protection Policy
- Procedures for Implementing the Requirements of the National Environmental Policy Act (40 CFR Part 6, Appendix A)

These ARARs apply only to the soil excavation which was completed in 2002. No further evaluation is necessary.

The following standards were identified as action-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Florida Storm Water Discharge Regulations, Chapter 62-25, F.A.C.
- Florida Water Well Permitting and Construction, Chapter 62-532, F.A.C.

The storm water regulation only applied during soil excavation which was completed in 2002. No further evaluation is necessary. The sections covering General Provisions for Water Well Permitting and Construction and Abandonment of Water Wells in 62-532, F.A.C. were repealed October 7, 2010. Monitoring well installation and abandonment are now addressed in the FDEP Monitoring Well Design and Construction Guidance Manual, 2008. The use of the guidance will not affect the protectiveness of the remedy.

5.7 TECHNICAL ASSESSMENT

5.7.1 Question A: Is the remedy functioning as intended by the ROD?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD.

Remedial Action Performance: Contaminated soil was removed from Site 15 and replaced with clean backfill. Monitored natural attenuation of groundwater contaminants is being conducted.

Early Indicators of Potential Remedy Failure: None, the source of the contaminants has been removed and natural attenuation monitoring is being conducted.

Implementation of Institutional Controls and Other Measures: The reporting and certification requirements for the LUCs are incorporated into the LUCAP between the Navy, USEPA, and FDEP. Site 15 will be available for industrial use. Residential use of the site would be prohibited, and the Navy would perform periodic site inspections and ensure the LUCs are being properly maintained and administered. Groundwater use is prohibited within 300 feet of the site. The Navy will conduct an annual review of the institutional controls and certify that the controls should either remain in place or be modified to reflect changing site conditions.

5.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure Assumptions: There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes to Standards and To Be Considered: ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes to standards since the remedy was implemented. The arsenic MCL per the Safe Drinking Water Act and Chapter 62-550, F.A.C. has been changed from 50 µg/L, which is the Performance Standard in the ROD, to 10 µg/L.

Changes in Exposure Pathways: No changes in the site conditions or land use that affect exposure pathways were identified as part of the Five-Year Review. Exposure to the site groundwater is still restricted by the LUC.

Changes in Toxicity and Other Contaminant Characteristics: There have been no changes in human health or ecological toxicity criteria that would impact protectiveness of the remedy.

Changes in Risk Assessment Methodologies: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

5.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has come to light that calls into question the protectiveness of the remedy.

5.8 ISSUES

Issues were discovered during the Five-Year Review and are noted in Table 5-4.

TABLE 5-4
OU4 ISSUES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Issues	Affects Protectiveness (Y/N)	
	Current	Future
Monitoring wells 15GGR1 and 15MW76 are missing.	N	N
An ESD is necessary to address the change in the arsenic MCL.	N	N

5.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

During the recent monitoring well inventories, it was documented that monitoring wells 15GGR1 and 15MW76 were no longer present on site. In accordance with the requirements of the LTM Plan, these monitoring wells 15GGR01 and 15MW76 need to be replaced.

An ESD needs to be prepared to change the Performance Standard in the ROD for arsenic (50 µg/L) to the current MCL per the Safe Drinking Water Act and Chapter 62-550, F.A.C which is 10 µg/L.

5.10 PROTECTIVENESS STATEMENT

This remedy is protective. Concentrations of COCs appear to be decreasing over time. Exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to, or the ingestion of contaminated groundwater.

6.0 OPERABLE UNIT 11

The OU11 ROD was signed by the Navy on September 28, 2006 and signed by USEPA on October 5, 2006. Implementation of the remedial actions at OU11 began in 2006. The initial Five-Year Review for OU11 was completed in 2008. This Five-Year Review consists of an approximate five-year period of data and provides a status update for OU11, Site 38 – Building 71 and 604 (hereinafter Site 38), surrounding areas, and the IWTP sewer line. This Five-Year Review for Site 38 is being conducted because contaminated wastes are still contained on site and do not allow for unlimited use and unrestricted exposure.

6.1 SITE CHRONOLOGY

A list of significant Site 38 historical events and relevant dates is provided in Table 6-1.

TABLE 6-1
OU11 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Aircraft painting and stripping conducted at Building 71	1935 – Late 1970’s
Metal plating operations at Building 604	1960 – 1996
Hazardous materials stored on second floor of Building 604	1970’s - 1996
Hazardous waste stored at Building 71	1980 - 1989
IAS on-site survey	1982
IAS Final Report	June 1983
Confirmation and Verification Study conducted	1984
Characterization Study conducted	1986
RCRA Facility Assessment	1988
RCRA/HSWA Permit issued	1988
RCRA Closure of hazardous waste storage facility	1989
Contamination assessment/RI – Phase I conducted	1991
UST removed from facility	1992
Contamination Assessment/RI – Phase II conducted	1993

TABLE 6-1
OU11 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Contamination detected in surface soil, subsurface soil, and shallow groundwater, soil and groundwater COCs identified and remedial goals established	1994-2004
Final Technical Memorandum, Evaluation of MNA at OU11, Site 38	December 1999
RCRA/HSWA Permit renewed	January 2002
Limited source removal activities conducted	2004
Final ROD	October 5, 2006
Remedial Design for Land Use Controls and Groundwater Monitoring at Operable Unit 11 (Draft)	November 29, 2010
Confirmatory Sampling Letter Report for OU11 Site 38	June 17, 2011

6.2 BACKGROUND

6.2.1 Physical Characteristics of OU11

Site 38 is within the boundaries of NAS Pensacola in Pensacola, Florida (Figure 1-2). Building 71, shown on Figure 6-1, was used from 1935 to the late 1970s for aircraft paint stripping and painting operations, and consisted of a steel-framed structure with metal siding on a 10 to 14 inch thick concrete slab. The building was approximately 100 feet wide by 160 feet long and approximately 35 feet high. An interior concrete block wall divided it into a northern half, curbed with concrete in several places, and a southern half enclosing 10 dip tanks. The building was demolished in 1993. Building 71 was used from 1935 to the late 1970s for aircraft paint stripping and painting operations.

From 1980 to 1989, hazardous waste was stored on the north side of Building 71, which was permitted for hazardous waste storage in January 1985 by the FDEP (formerly the FDER) (NEESA, 1985). Waste stored during this period reportedly consisted of solvents, acids, caustics, oxidizers, and liquid and non-liquid toxic materials (E&E, 1992).

Wastes from various operations at Site 38 (including paint stripping) were discharged to Pensacola Bay until the IWTP was built in 1973. Wastes previously entered the IWTP sewer line by gravity feed and force main without any pretreatment or segregation. Except for one 18-foot section constructed of 8-inch diameter polyvinyl chloride (PVC) pipe, the lines in this area are constructed of 8 to 12 inch diameter vitrified clay with hub and spigot joints. Building 3435, north of the Building 71 area, housed the lift station for the force main. The interconnected gravity lines, which previously served operations at Building 604 and Building 71, flow to the lift station at Building 3435. The force main extends northeast from the lift station where it eventually discharged to the IWTP (EnSafe, 2005a).

Building 604, shown on Figure 6-1, was an irregularly shaped, brick/masonry structure built in 1937. NADEP metal plating operations were located in Building 604 until it was closed in May 1996 (EnSafe, 2005a).

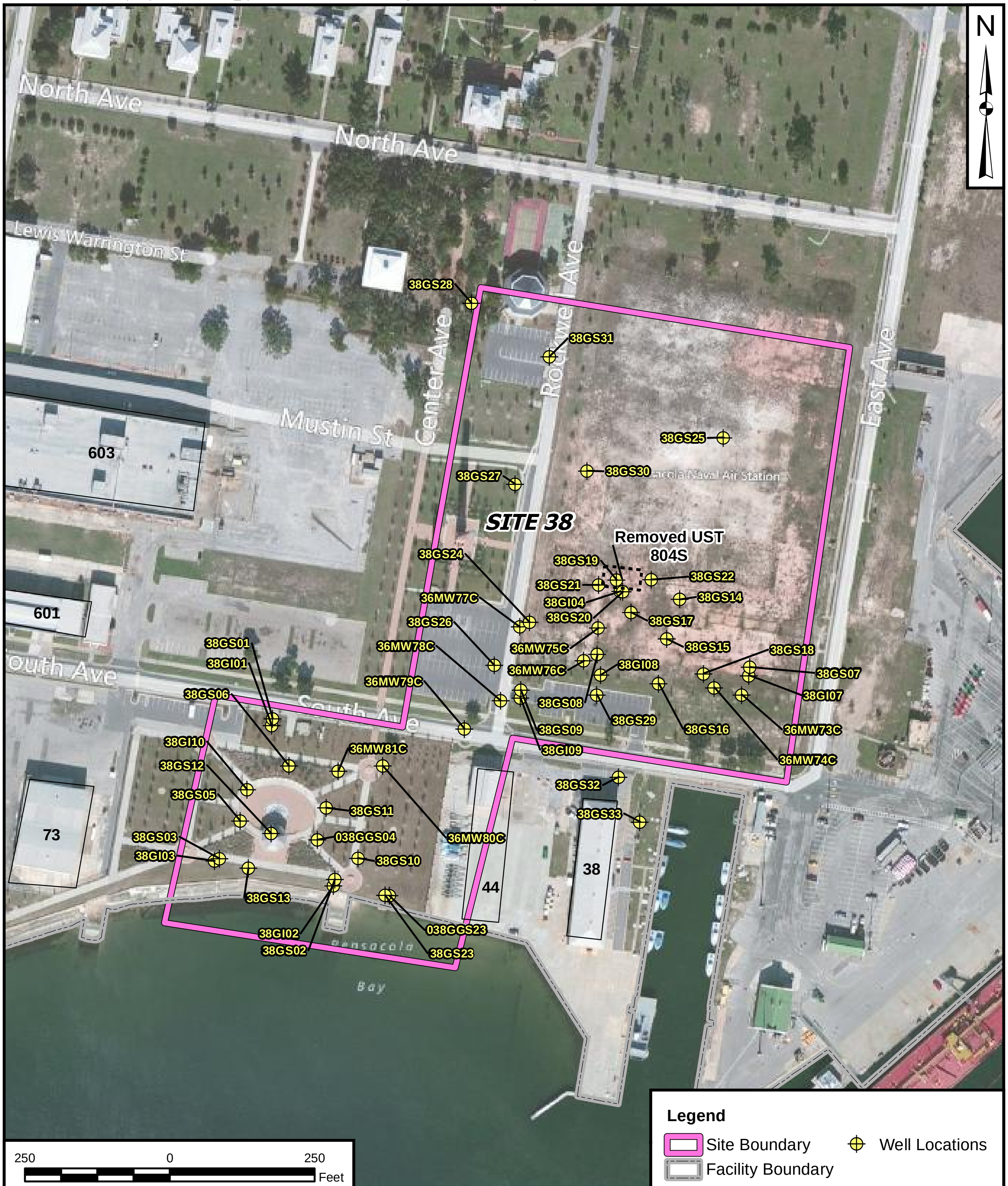
Initial plating operations were conducted in the western portion of Building 604 from approximately 1960 until the shop was demolished around 1970 (NEESA, 1983). Plating operations were subsequently transferred to a larger plating shop, constructed in 1970, in the southwest portion of Building 604. Three cadmium plating lines and a magnesium treatment line were located in the plating shop. Chromium was used in the magnesium treatment process. NEESA (1983) reports that 50-gallon tanks containing chromium solutions were drained approximately once per month; larger tanks were present but were drained less frequently. Reportedly, these tanks were emptied into sewer lines that discharged into Pensacola Bay (NEESA, 1983). Cyanide solutions were also used in the plating process, and prior 1962, cyanide waste was disposed in the sanitary sewer. Cyanide and chromium wastes that were dumped into the sewer system were routed to bypass the treatment plant and flowed untreated into Pensacola Bay. Hazardous materials were stored on the second floor of Building 604.

6.2.2 Land and Resource Use at OU11

Site 38 is located north of Pensacola Bay along Radford Boulevard, in the southeastern portion of the NAS Pensacola facility. The site, formerly an approximate 12 acre industrial area, was primarily paved or covered by buildings. Building 71 was used from 1935 to the late 1970s for aircraft paint stripping and painting operations. Wastes from various operations, including paint stripping, were discharged to the Pensacola Bay until the IWTP was built in 1973. Building 604 housed the NADEP metal plating operations until it was closed in May 1996. This two-story, irregularly shaped, brick masonry structure was built in 1937 as a hangar on the west side of East Avenue in the old Navy yard.

The area is generally flat with land surface elevations approximately 3 to 8 feet above mean sea level. Rainfall is addressed via an existing storm water management system (EnSafe, 2005a). Groundwater flow generally mimics the peninsular topography and flows to the south towards Pensacola Bay. Groundwater is not used as a potable water source at OU11 (EnSafe, 2005a). The main source of potable water for NAS Pensacola is the Navy-owned well field located at NTTC Corry Station, which is located approximately three miles north of NAS Pensacola on the northern (opposite) side of Bayou Grande.

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU11Site38.mxd [alex.montalvo 6/5/2012]



DRAWN BY GIS	DATE 6/5/2012	NAVFAC	SITE MAP - OPERABLE UNIT 11 5 YEAR REVIEW NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NUMBER 112G00702	CTO NUMBER 067
CHECKED BY A.I.	DATE 6/5/2012			APPROVED BY ___	DATE ___
REVISED BY	DATE			APPROVED BY ___	DATE ___
SCALE AS NOTED				FIGURE NO. 6 - 1	REV 0

Many of the buildings in the Site 38 area were damaged in 2004 by Hurricane Ivan and subsequently demolished. The Building 71 area is currently a recreational area that is used for ceremonial activities. The Building 71 area is mostly grass and shrubbery bordered by concrete sidewalks, a small parking area is on the northern portion of the site for parking. Much of the Building 64 area is a natural area and parts of the southern end of the site is used for parking. Future uses for Site 38 are limited to commercial/industrial and recreational land use. The projected future land use for these areas is designated as green space area that includes a walking trail along the Pensacola Bay waterfront.

6.3 HISTORY OF CONTAMINATION

Site 38 was found to have contaminated soil and groundwater at Buildings 71 and 604 that were associated with the IWTP sewer line areas. Soil data generated by various investigations at Site 38 identified constituents in surface and subsurface soil above Florida's applicable Chapter 62-777, F.A.C. residential and industrial direct exposure SCTLs, and Leachability to Groundwater SCTLs.

Contaminants identified in the surface soil in the Building 71 study area included inorganics, SVOCs, pesticides, and PCBs. Soils that contained organic exceedances of industrial direct exposure and Leachability to Groundwater SCTLs were limited in areal extent, and pesticide and PCB exceedances were limited to two locations. Pesticide detections in these areas are likely the result of pesticide application. Contaminants identified in the subsurface soil included inorganics, SVOCs, pesticides, and VOCs, with much of the contamination underneath the building. The contaminants are likely the result of past paint stripping and metal refinishing activities at Building 71.

Contaminants identified in the surface soil in the Building 604 study area included inorganics, SVOCs, pesticides, and PCBs. The exceedances of industrial direct exposure and Leachability to Groundwater SCTLs were limited in areal extent. Pesticide detections in these areas are likely the result of pesticide application. Contaminants identified in the subsurface soil included inorganics, SVOCs, pesticides, and VOCs. The contaminants are likely the result of past plating activities at Building 604.

6.3.1 Initial Investigation at OU11

The hazard presented by potential exposure to the contaminants identified at Site 38 initiated a baseline risk assessment in accordance with USEPA and FDEP guidance. The results of the baseline risk assessment prompted the performance of a preliminary risk evaluation of potential risks from site constituents to human receptors at the site. The risks calculated in a preliminary risk evaluation are derived by a comparison of exposure concentrations to CTLs. These CTLs are derived using default exposure assumptions established by the USEPA and FDEP. There are no deviations between the Navy and the regulatory agencies regarding those exposure assumptions or pathways defined by the regulatory agencies for residential and industrial exposures. Florida's acceptable risk is 1.0E-6 (1 in 1,000,000) and it is that risk level on which CTLs are based. The USEPA's acceptable target risk range is 1.0E-4 to 1.0E-6 (1 in 10,000 to 1 in 1,000,000). Preliminary risk evaluation is the risk evaluation tool on which remedial decisions are based, and was conducted to refine the list of potential contaminants to actual COCs using guidance by USEPA and FDEP.

6.3.2 Basis for Taking Action at OU11

The RI included a baseline risk assessment to determine potential risks to human health from exposure to contaminants in soil and groundwater. Contaminants were detected in concentrations causing unacceptable risk for future residents within various media at Site 38. COCs related to each medium are summarized in Table 6-2.

TABLE 6-2
OU11 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Site 38 Building 71 – Soil	Site 38 Building 71 – Shallow Groundwater
Arsenic	Acenaphthalene
Chromium	Dibenzofuran
Copper	Fluorene
Lead	Naphthalene
Aroclor 1254	Ethylbenzene
Benzo(a)pyrene	Tetrachloroethene
Phenol	Trichloroethene
1,2-Dichloroethane	Vinyl Chloride
2-Methylphenol	Barium
4-Methylphenol	Cadmium
Tetrachloroethene	Copper
Trichloroethene	Iron
	Manganese
	Zinc

TABLE 6-2
OU11 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Site 38, Building 604 – Soil	Site 38, Building 604 – Shallow Groundwater
Antimony	Acenaphthalene
Arsenic	Anthracene
Cadmium	Dibenzofuran
Chromium	Fluoranthene
Copper	Naphthalene
Lead	Phenanthrene
Beta-BHC	Pyrene
Delta-BHC	1,2,-Dibro-3-Chloropropar
Dieldrin	Ethylbenzene
Benzo(a)anthracene	Tetrachloroethene
Benzo(a)pyrene	Trichloroethene
Benzo(b)fluoranthene	Vinyl Chloride
Dibenzo(a,h)anthracene	Barium
Methylene Chloride	Cadmium
Tetrachloroethene	Copper
Perchloroethene	Iron
	Manganese
	Mercury

The concentrations of contaminants detected in the soil samples collected at Site 38 are not within the USEPA and FDEP acceptable risk range for current workers, trespassers, and future residents (Tetra Tech, 2006a). Contaminant concentrations in groundwater were compared against promulgated regulatory criteria per the Safe Drinking Water Act, Chapter 62-550, F.A.C. and Chapter 62-777, F.A.C., and to evaluate potential unacceptable risk due to use/consumption of the water and if natural attenuation may occur. Contaminants exceeding any of these regulatory criteria were listed as COCs.

It was determined there are no unacceptable risks to ecological receptors associated with surface soil contamination, primarily because natural terrestrial habitat features were not present in or around Site 38. The only terrestrial receptors are shorebirds that periodically visit the area. In addition, most of the site was formerly covered by asphalt, concrete, or buildings, and contamination within former small grassy areas was minimal. The removal of the top 2 feet of soil across Site 38 that contained COCs makes the exposure pathway for surface soil contamination incomplete.

6.4 REMEDIAL ACTIONS

6.4.1 Remedy Selection at OU11

The ROD for OU11 was signed on October 5, 2006. RAOs were developed from the data collected during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD. The goals of the selected soil and groundwater remedies at OU11 are to protect human health and the environment by eliminating, reducing, or controlling hazards posed by the site and to meet ARARs. Table 6-3 lists the RAOs for OU11.

**TABLE 6-3
OU11 REMEDIAL ACTION OBJECTIVES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA**

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Soil	Antimony, Arsenic, Cadmium, Chromium, Copper, Lead, Beta-BHC, Delta-BHC, Dieldrin, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Methylene Chloride, Tetrachloroethene, and Perchloroethene	Prevent unacceptable risk from exposure to surface soil.
Groundwater	Acenaphthalene, Anthracene, Dibenzofuran, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, Phenanthrene, Pyrene, 1,2 Dibromo-3-chloropropar, Ethylbenzene, Tetrachloroethene, Trichloroethene, Vinyl Chloride, Barium, Cadmium, Copper, Iron, Lead, Manganese, Mercury, and Zinc	• Prevent unacceptable risk from ingestion of groundwater with concentrations greater than the Florida CTLs and federal MCL • Reduce detected concentrations in groundwater to less than the Florida CTLs and federal MCL • Reduce detected concentrations in groundwater next to the surface water body to below Florida surface water CTLs and federal water criteria.

Five remedial alternatives were considered for soil at Site 38. Of the alternatives evaluated, the selected remedial action was Soil Alternative S4: excavation of industrial direct exposure “hot spots” (3X industrial direct exposure SCTLs) and leachability to groundwater criteria exceedances with off-site disposal and LUCs to prevent residential use. The major components of Alternative S4 are listed below:

- Exposed surface soils exceeding three times the industrial direct exposure SCTLs and leachability to groundwater SCTLs to be excavated and disposed of at an appropriate disposal facility.
- Maintenance of existing asphalt and concrete paved areas covering areas.
- LUCs to prohibit use of the site for residential or residential-like uses and prohibit excavation and removal of subsurface soil unless prior written approval is obtained from the Navy, USEPA, and FDEP.

Three remedial alternatives were considered for groundwater at Site 38. Of the alternatives evaluated, the selected remedial action was Groundwater Alternative G2: natural attenuation, LUCs, and groundwater monitoring to address contaminants in groundwater. The major components of Alternative G2 are listed below:

- MNA.
- LUCs to prevent access and prohibit all use of groundwater from the surficial aquifer underlying the site without prior written approval from the Navy, USEPA, and FDEP, and maintain the integrity of any existing or future monitoring or remediation system.

The remedies were selected for the following reasons:

- Except for the areas identified for removal, detected concentrations of COCs remaining in soil do not present an unacceptable threat to human health or the environment assuming that only industrial and/or commercial uses are permitted at Site 38 and the existing caps are maintained. Because of Hurricane Ivan damage, the Navy removed the buildings and associated parking lots. Surface soil areas identified as exceeding industrial direct exposure SCTLs were to be removed and replaced with clean fill to prevent unacceptable exposure.
- Although contamination is present in groundwater at concentrations greater than federal and Florida CTLs, detected concentrations are relatively low and do not present an unacceptable threat to human health or the environment under the groundwater use restrictions to be implemented as part of the selected remedy.
- The contaminant plume is small and stable and confined to the shallow aquifer, and there is no evidence of ongoing contaminant migration.

6.4.2 Remedy Implementation at OU11

According to NAS Pensacola personnel, the building structures, parking lot surface and surficial soil at Site 38 were removed in 2004 during the cleanup of hurricane damaged structures and related debris. However, the contractor that performed the work did not adequately document the source removal activity; however, waste disposal manifests documenting the volume of soil removed are available. Below is a description of the cleanup activities conducted at Site 38.

Building 604: Building 604 was demolished and contaminated soil that was identified during the RI to occur from the land surface to 2 feet bls was removed and disposed of between February to March 2006. The soil excavation boundaries and land surface elevations prior to excavation, after excavation and upon final grade of backfill were not surveyed at the Building 604 area; however, Navy personnel conducted periodic inspections to ensure that excavation boundaries and depths occurred as per the contract specifications. A sample was collected from the excavated soil and analyzed utilizing the TCLP, The results indicated that the soil was a non-hazardous waste. Confirmation samples were not collected for chemical analysis. The contractor placed 2 feet of clean backfill into the excavation pit at the Building 604 area, then re-graded and grass/seeded the area. The clean backfill was not tested for any chemical parameters prior to being placed into the excavation pit.

Building 71: Following Hurricane Ivan in 2004, the onsite buildings and hurricane debris was removed. Contaminated soil from the land surface to 2 feet bls was also removed and disposed of. Four soil samples were collected from the excavated soil and analyzed utilizing the TCLP; the TCLP analytical results indicated that the soil was a non-hazardous waste. Confirmation samples were not collected for chemical analysis. The soil excavation boundaries and land surface elevations prior to excavation, after excavation, and upon final grade of backfill were surveyed at the Building 71 area. The contractor placed 2 feet of clean backfill into the excavation pit, then re-graded and sodded the area. The backfill was tested for a hazardous waste utilizing the TCLP test prior to being placed into the excavation pit. The soil was found to be non-hazardous and could be disposed of at a RCRA Subtitle D landfill. However, because totals analysis was not conducted for VOCs, SVOCs, pesticides, PCBs, and metals, it was determined that the analysis did not meet FDEP and USEPA requirements of determining whether the backfill soil was "clean" (e.g., did not contain constituents at concentrations that would exceed regulatory screening criteria for direct exposure or leachability to groundwater). In late 2008, as part of a larger water front reuse project the Building 71 area was extensively landscaped and a ceremonial pavilion was constructed.

In July 2009, Tetra Tech on behalf of the Navy completed a supplemental confirmation soil sampling event at OU11, Site 38. The study was conducted to determine if the top 2 feet of soil was removed in the specific areas identified in the ROD; if the top 5 feet of soil was removed in the specific areas identified in the ROD; and to determine if clean fill material was used as a replacement for the removed soil.

The study included collection of 27 soil samples including six soil samples of the fill material to verify that clean fill was used on site. The samples were analyzed for select parameters and a specific dieldrin risk evaluation/discussion was completed. The study recommendations indicated that the concentrations of the COPCs detected in the soil samples met the criteria for No Further Action to achieve the objectives of the selected remedy in the final ROD. Additionally, asphalt and the soil backfill at Site 38 provide an effective cover to mitigate direct contact with the COPCs that remain at the site as was the intent of the selected remedy of LUCs that were described in the final ROD. Therefore, the soil excavation remedy is believed to be protective and the OU11 Remedial Design should be completed to include implementation of the LUCs.

A UFP-SAP was submitted in April 2010 for conducting natural attenuation monitoring at Site 38 per the ROD (Tetra Tech, 2006b). Implementation of the Site 38 UFP-SAP is pending regulatory approval of the Groundwater Monitoring Plan for OU11, Site 38. Also, based on comments provided by the USEPA, more current groundwater data is required at adjacent IR Sites 45 and 46 to support the respective Draft Proposed Plans. The NAS Pensacola Partnering Team agreed during their meeting on December 13 and 14, 2011 that the Navy would amend the UFP-SAP for OU11, Site 38 to include collecting a round of groundwater samples from monitoring wells at Sites 45 and 46 to assess the current conditions of COCs at Site 45 and Site 46. The monitoring has not been initiated because regulatory approval has not been received.

To date no cost associated with site remediation have been expended.

6.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

A draft Land Use Control Remedial Design (LUCRD) for soil and groundwater was submitted in December 2011. A response to regulatory comments is being prepared.

6.5.1 Protectiveness Statements from the Last Review

The 2008 Five-Year Review concluded that the remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals through natural attenuation. In addition, the previous Five-Year Review stated that in the interim, exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater.

Issues identified in the 2008 Five-Year Review and actions taken are summarized in Table 6-4.

TABLE 6-4
OU11 ISSUES IDENTIFIED AND ACTIONS TAKEN
2008 FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Issues Identified in 2008 Five-Year Review	Actions Taken Since the 2008 Five-Year Review
A source removal action was completed in 2007 using Hurricane Ivan funds; however, the extent of the excavated site area was not documented.	A soil confirmation report to confirm the extent of soil excavations and use of proper fill has been completed.
Groundwater Natural Attenuation monitoring will begin in December 2008.	The monitoring plan is in development. A UFP-SAP has been prepared and is being modified to include confirmation sampling and analysis activities for OU20, Site 45 and OU21, Site 46.

6.5.2 Status of Recommendations and Follow-up Actions from Last Review

Table 6-5 provides a list of recommendations, recommended follow-up actions from the 2008 Five-Year Review, milestone dates, actions taken, outcomes, and dates of action.

TABLE 6-5
OU11 RECOMMENDATIONS AND FOLLOW-UP ACTIONS
2008 FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Yes or No)	
					Current	**Future**
1	Conduct confirmatory soil sampling and analysis to verify successful abatement of impacted soil	Navy	USEPA	December 2008	No	Yes
2	Implement Natural Attenuation Monitoring	Navy	USEPA	December 2008	Yes	Yes

6.5.2.1 Follow Up Actions Taken for Item 1 from Table 6-5

Confirmation soil sampling conducted during July 2009 at Site 38 and a final report was submitted to the USEPA and FDEP in June 2011. The confirmation samples were collected to determine if the contaminated soil that exceeded three times the Florida industrial direct exposure SCTLs and/or leaching to groundwater SCTLs has been removed from the Building 604 area north of Radford Boulevard as specified in the ROD. The confirmation soil sampling results indicate that the COCs detected in the soil samples at sampling locations BT38, BT41, BT42, SS26, and S78S met the criteria for No Further Action to achieve the objectives of the selected remedy in the final ROD (Tetra Tech, 2006a). Additionally, asphalt and the soil backfill at Site 38 provide an effective cover to mitigate direct contact with the COCs that remain at site as was the intent of the selected remedy of LUCs that were described in the final ROD.

6.5.2.2 Follow Up Actions Taken for Item 2 from Table 6-5

A Groundwater Monitoring Plan and UFP-SAP for a natural attenuation groundwater monitoring program are being prepared. Drafts of the two documents have been submitted for regulatory review and approval.

6.6 FIVE-YEAR REVIEW PROCESS

This is the second Five-Year Review for this site. Members of the NAS Pensacola Partnering Team were notified of the initiation of the Five-Year Review in January 2012. The Five-Year Review was led by Gerald Walker of Tetra Tech, the NAVFAC SE Navy CLEAN Contractor, and included other Tetra Tech staff. Patty Marajh-Whittemore of NAVFAC SE, Greg Campbell of NAS Pensacola Public Works Department, Tim Woolheater of USEPA, David Grabka of FDEP, and Sam Naik of CH2M Hill assisted in the review.

The review included the following components:

- Document Review
- Data Review
- Site Inspection
- Five-Year Review Report development and review

6.6.1 Document Review

This Five-Year Review consisted of a review of relevant documents including the ROD, and applicable federal and state statutes.

6.6.2 Data Review

Source removal activities were conducted at OU11, Site 38 in conjunction with cleanup of hurricane related debris, and clean fill was placed in the excavated areas to limit direct exposure to soil containing the COCs remaining in subsurface soils at the site. Monitoring of natural attenuation of groundwater quality has not been initiated. The Navy is preparing documentation for the source removal activity at Site 38.

6.6.3 LUC Inspections

LUC inspections were conducted annually at OU11 during the period under review. The inspections noted no problematic observations. Copies of the annual certifications are provided in Appendix F.

6.6.4 Site Inspection and Interviews

Inspections at the site were conducted on May 3, 2012, by Tetra Tech personnel. The purpose of the inspection was to assess the protectiveness of the remedy, including general site condition and condition of the monitoring wells. At the time of the inspection, institutional controls appeared to be adequate, and use of groundwater was not observed. Roadways within Site 38 appeared adequate, and there were no apparent signs of vandalism or trespassing.

Since surficial soil with contaminant concentrations above the remedial goal were reportedly removed, fencing the site was not warranted. Existing monitoring wells were accessible and in good condition. Many monitoring wells at the Building 604 “return to nature” area were not present and were either abandoned or covered by fill. However, new replacement monitoring wells are to be installed for the natural attenuation monitoring program. Therefore, deficiencies were not noted during the site inspection.

An interview was conducted with Greg Campbell, Environmental Engineer for NAS Pensacola, on May 2, 2012. According to the interview, Mr. Campbell indicated he is well informed about the site’s activities and progress, and was not aware of any community concerns regarding the site or its operation, or of any incidents such as vandalism, trespassing, or emergency responses at the site. The interview forms are presented in Appendix F.

Mr. Campbell indicated annual LUC inspections are performed. In addition, complaints, violations, or other incidents related to the site requiring a response by his office have not occurred.

6.6.5 ARAR Level Changes

The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Safe Drinking Water Act MCLs (40 CFR 141.11–141.16)
- Safe Drinking Water Act MCLGs (40 CFR 141.50–141.51)
- Safe Drinking Water Act Secondary Drinking Water Standards (40 CFR 143)
- Cancer Slope Factors (CSFs) (Integrated Risk Information System)
- Reference Dose Factors (RfDs) (Integrated Risk Information System)
- Florida SCTLs, Chapter 62-777, F.A.C.
- Florida Ground Water Guidance Concentrations
- Florida Drinking Water Standards, Monitoring and Reporting, Chapter 62-550, F.A.C.
- Ground Water Classes, Standards, and Exemptions, Chapter 62-520, F.A.C.

Since signing the ROD for OU11 in October 5, 2006, there have not been any changes to the above regulations that affect the protectiveness of the remedy.

The soil criteria in the selected remedy included meeting industrial direct exposure SCTLs and leachability to groundwater criteria. These criteria are listed on Tables 2-1 and 2-2 of the ROD. The values in the table were compared to the current version of Chapter 62-777, F.A.C., and no differences were found. The remediation goals are protective.

The Remedial Goals in Table 2-3 from the ROD include CTLs and MSWCTLs. The values in the table were compared to the current version of Chapter 62-777, F.A.C. In the absence of an MSWCTL, the water quality criteria for Class III Marine Waters in Chapter 62-302, F.A.C. were used. A few differences were noted as summarized in Table 6-6.

The ROD values for phenanthrene and copper are more restrictive than the current values, so there is no change in the protectiveness is the current values are used. The ROD value for cadmium is slightly greater than the current value, so there may be slightly less protectiveness. The natural attenuation monitoring program has not been implemented.

TABLE 6-6
OU11 REMEDIAL GOALS
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Parameter	Type of Remedial Goal	Value from ROD Table 2-3 µg/L	Value from Chapter 62-302, F.A.C., µg/L
Phenanthrene	MSWCTL	0.3	Part of Total PAHs of 31 µg/L
Cadmium	MSWCTL	9.3	8.8
Copper	MSWCTL	2.9	3.7

µg/L = microgram per liter

MSWCTL = Marine Surface Water Cleanup Target Level

The following standards were identified in the ROD as location-specific ARARs. They were reviewed for changes that could affect protectiveness:

- National Environmental Policy Act (40 CFR Part 6, Appendix A)
- Fish and Wildlife Coordination Act (40 CFR 6.302)
- Executive Order 11988 Wetlands Protection Policy

The soil excavation is complete, so the location-specific ARARs are no longer pertinent and were not evaluated further.

The following standards were identified as action-specific ARARs for OU11:

- RCRA Identification and Listing of Hazardous Wastes (40 CFR 261)
- RCRA Generator Standards (40 CFR 262)
- RCRA Location Requirements (40 CFR 264.18)
- RCRA Facility Standards (40 CFR 265, Subparts C, D, I, J and L)
- RCRA Land Disposal Restrictions (40 CFR 268)
- Department of Transportation (DOT) Rules for Transport of Hazardous Substances (49 CFR Parts 107 and 171-179)
- USEPA Monitored Natural Attenuation Guidance
- Florida Stormwater Discharge Regulations, Chapter 62-25, F.A.C.

- Florida Hazardous Substance Release Notification Rules, Chapter 62-150, F.A.C.
- Florida Hazardous Waste Rules, Chapter 62-730, F.A.C.
- Florida Rules on Hazardous Waste Warning Signs — July 1991
- Florida Water Well Permitting and Construction Requirements Chapter 62-532, F.A.C.

The soil excavation is complete, so the RCRA, DOT, Florida Stormwater, Florida Hazardous Substance, and Florida Hazardous Waste are no longer pertinent and were not evaluated further. The groundwater monitoring program has not been implemented, so the USEPA Monitored Natural Attenuation Guidance was not evaluated. The sections covering General Provisions for Water Well Permitting and Construction and Abandonment of Water Wells in 62-532, F.A.C. were repealed October 7, 2010. Monitoring well installation and abandonment are now addressed in the FDEP Monitoring Well Design and Construction Guidance Manual, 2008.

6.7 TECHNICAL ASSESSMENT

6.7.1 Question A: Is the remedy functioning as intended by the ROD?

The remedy is not yet functioning as intended, as MNA has yet to be initiated.

Remedial Action Performance: Surface soil containing COCs were removed from Site 38 and replaced with clean backfill. MNA of the COCs remaining at the site has not been initiated.

System O&M: There are no active remediation systems at OU11, therefore no system O&M is required.

Cost of System Operations/O&M: There are no active remediation systems at OU11, therefore no system O&M is required.

Early Indications of Potential Remedy Failure: None.

Implementation of Institutional Controls and Other Measures: LUCs have been implemented as evidenced by the NAS Pensacola Master Plan dated December 2007.

6.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure Assumptions: There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes to Standards and To Be Considered: ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes to standards since the remedy was implemented. For soil, there are no changes to the cleanup goals identified in the ROD. For groundwater, there are two COCs that currently have less stringent cleanup criteria compared to the ROD (phenanthrene and copper), and there is one COC (cadmium) that currently has a slightly more stringent criterion compared to the ROD.

The LTM Plan was prepared according to the action-specific ARAR for LTM Plans.

Changes in Exposure Pathways: No changes in the site conditions or land use that affect exposure pathways were identified as part of the Five-Year Review. Exposure to the site groundwater is still restricted by the institutional controls.

Changes in Toxicity and Other Contaminant Characteristics: There have been no changes in human health or ecological toxicity criteria that would impact protectiveness of the remedy.

Changes in Risk Assessment Methodologies: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

6.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has come to light that calls into question the protectiveness of the remedy.

6.8 ISSUES

Issues were discovered during the Five-Year Review and are noted in Table 6-7.

TABLE 6-7
OU11 ISSUES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Issues	Affects Protectiveness (Y/N)	
	Current	Future
MNA has not yet been initiated.	Yes	Yes

6.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow up actions are provided in Table 6-8.

TABLE 6-8
OU11 RECOMMENDATIONS AND FOLLOW-UP ACTIONS
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Yes or No)	
				Current	Future
Implement Natural Attenuation Monitoring	Navy	USEPA		Yes	Yes

6.10 PROTECTIVENESS STATEMENT

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through natural attenuation. The remedy is protective in the short term as institutional controls are currently being implemented.

7.0 OPERABLE UNIT 13

The OU13 ROD was signed by the Navy on September 28, 2006 and by USEPA on October 5, 2006. Implementation of the remedial actions at OU13 began in 2007. This Five-Year Review consisted of historic and current data collected over a five-year period and provides a status update for OU13 Sites 8 (Rifle Range Disposal Area) and 24 (DDT Mixing Area).

This Five-Year Review for OU13 is being conducted because contaminated wastes remain on site and do not allow for UU and UE.

7.1 SITE CHRONOLOGY

A list of important OU13 historical events and relevant dates in the site chronology is shown in Table 7-1.

**TABLE 7-1
OU13 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA**

Event	Date
Waste disposal activities initiated at Site 8	Late 1950s – Early 1960’s
Dichlorodiphenyltrichloroethane (DDT) mixing conducted at Site 24	Early 1950 – Early 1960’s
Building No. 3561 constructed at Site 8 location	1976
IAS on-site survey	1983
Phase I screening investigation conducted	1991
RI/Focused FS completed	1996
RI Report filed	1997
RI Report Addendum issued	September 1999
MOA issued	November 1999
Focused FS issued	May 2000
Focused FS Addendum issued	September 2001
IRA conducted at Site 8	2002 – 2004
IRA Report issued for Site 8	2004
Final ROD issued	October 5, 2006
Groundwater Monitoring Plan issued	2007

TABLE 7-1
OU13 SITE CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Event	Date
Remedial Design approved	September 19, 2007
RD for LUC and Groundwater Monitoring	August 2008
Semiannual Groundwater Monitoring Report	May 2008
Semiannual Groundwater Monitoring Report	October 2008
Semiannual Groundwater Monitoring Report	May 2009
Semiannual Groundwater Monitoring Report	June 2009
Semiannual Groundwater Monitoring Report	April 2010
Semiannual Groundwater Monitoring Report	July 2010
Semiannual Groundwater Monitoring Report	March 2011

7.2 BACKGROUND

7.2.1 Physical Characteristics

OU13 is comprised of Site 8 (Rifle Range Disposal Area) and Site 24 (DDT Mixing Area), which border the eastern side of John H. Tower Road and are located southeast of the intersection of John H. Tower and Taylor Roads at NAS Pensacola (Figure 7-1). The site is located in an industrialized portion of NAS Pensacola.

Site 8

Site 8, shown in Figure 7-1, is an approximate 450- by 600-foot area currently occupied by Building 3561, which houses the NAS Pensacola PWC Maintenance/Material Department. An extensive asphalt-paved area surrounds Building 3561 to the north, east, and west, covering nearly all land surface. The PWC stores building materials on the paved area west of the building.

Various solid wastes and dry refuse were reportedly placed in trenches and burned at Site 8 during the late 1950s and early 1960s. Aerial photographs and maps from the 1950s and 1960s show a rifle range at Building 3561’s current location. Earlier aerial photographs show an excavation at the northern end of the rifle range, and later photographs show the excavated area as overgrown with vegetation. Most of the excavation area observed in earlier photographs is currently covered by Building 3561 and surrounding paved area, which were constructed during the mid-1970s. Facility personnel reported waste or residue were not identified during the building's construction (NEESA, 1983). However, cemetery personnel have reported finding buried metal, rubber, and plastic aircraft parts during excavation along Site 24's eastern boundary (Tetra Tech, 2006b). Building 3561 was constructed in the mid-1970s and is first visible in aerial photographs from April 1976. During most of the 1980s, a limited portion of Building 3561 was used as a pesticide storage and equipment rinsing area. A tank wash rack rinsing area was constructed in March 1981 midway along Building 3561's eastern side to contain and collect pesticide equipment wash water and rinsate. Wastewater from the wash rack was discharged to the sanitary sewer system. Base pest control operations were moved from Building 3561 to their current location at Building 1538 in the early 1990s (NEESA, 1983; Tetra Tech, 2006b).

Other buildings within the Site 8 area include:

- Building 3680, Hazardous Material Storage Building
- Building 3817, Gas Bottle Storage Shed
- Building 3834, Material Storage
- Building 3816, Lumber Storage Shed

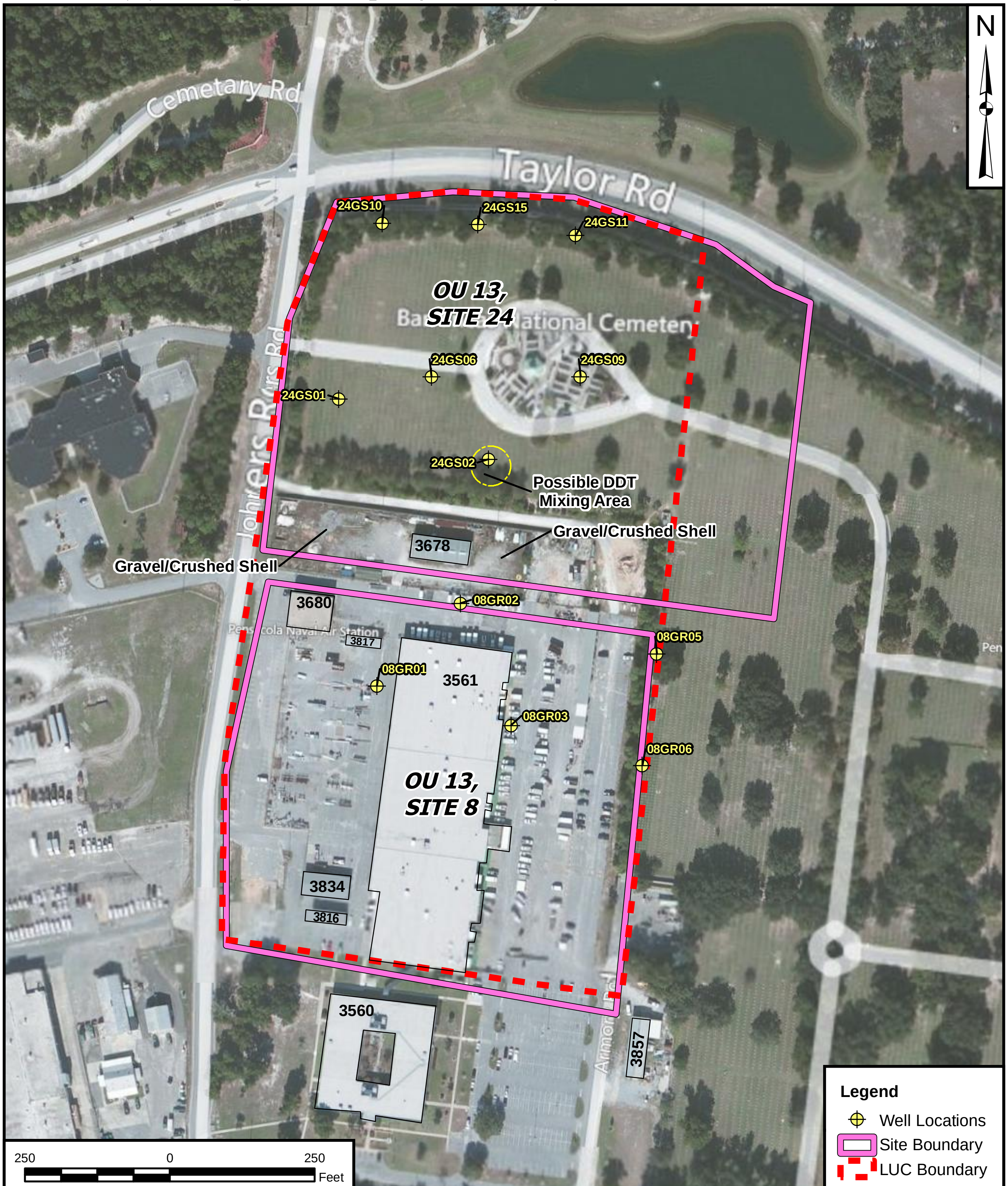
Site 24

Site 24, shown in Figure 7-1, is immediately north of Building 3561, near the northwest corner of the Barrancas National Cemetery. The central and northern portions of Site 24 are primarily unpaved and sparsely covered with native grasses and trees. However, the fenced storage area around Building 3678, in Site 24's southern portion, has a gravel/crushed shell land surface. An unimproved dirt road runs west to east across the site's center.

From the early 1950s until the early 1960s, Site 24 was used to mix DDT with diesel fuel for mosquito control. Reportedly, DDT was spilled in the mixing area during transfer from drums to spray tanks, and may have contaminated local soil and groundwater. DDT was aerially applied for at least 10 years to control mosquito outbreaks. In later years, DDT was applied by a fogger machine. It is estimated that up to 20 gallons of diesel/DDT solution may have been spilled during the years of operation at the site (NEESA, 1983).

The fenced storage area north of Building 3561 was developed during the mid-1980s and the PWC storage building was constructed inside the fenced area prior to November 1989. A water supply well (NAS Pensacola Well No. 1) that is no longer used is located upgradient of the combined site area, approximately 0.3 miles to the southeast; potable water is currently obtained from NTTC Corry Station. The NAS Pensacola Well No. 1 is screened in the main producing zone beneath the low permeability zone, which separates it from the surficial aquifer.

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU13Site8_24.mxd [alex.montalvo 7/18/2012]



DRAWN BY	DATE		SITE MAP - OPERABLE UNIT 13 5 YEAR REVIEW NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NUMBER 112G00702	CTO NUMBER 067
GIS	7/18/2012	NAVFAC		APPROVED BY	DATE
CHECKED BY	DATE				
A.I.	7/18/2012			APPROVED BY	DATE
REVISED BY	DATE				
SCALE AS NOTED				FIGURE NO. 7 - 1	REV 0

There are several other IR Program sites nearby. Site 22 (the Refueler Repair Shop) is directly west, across John Tower Road and is now part of the petroleum program. Site 17 (the Transformer Storage Yard) is approximately 1,300 feet southwest and the southern boundary of OU1 (the Sanitary Landfill) is located approximately 200 feet northwest of the John Tower/ Taylor Road intersection (Tetra Tech, 2006b).

7.2.2 Land and Resource Use

Site 8 is generally flat with a land surface elevation averaging 29 feet above mean sea level. Miscellaneous office trailers and fenced storage, including Building 3561, are within the Site 8 boundaries. The paved area east of Building 3561 is used for PWC storage and employee parking. Sidewalks and a grassy median are to the south, between Buildings 3560 and 3561. Although it is not completely shown on the figure, most of Site 8 is surrounded by chain-link fencing. Site use is projected to remain consistent with current use. At Site 8, the depth-to-water measurements ranged from approximately 8 feet bls across most of the site to approximately 11 feet bls in the northeastern portion of the site.

Site 24 is generally flat with land surface elevations approximately 24 to 26 feet above mean sea level. Surface drainage across the site is precluded by the high permeability of the surficial soil which allows direct, rapid infiltration of precipitation. The Barrancas National Cemetery currently occupies most of the Site; however, Building 3678 is located on the southern end of the site boundary. Depth-to-water measurements at Site 24 ranged from approximately 5.5 feet bls in the western portion to approximately 8.5 feet bls in the southern portion. Overall, this flow regime generally mimics the local topography, sloping slightly north-northeast across the area. Groundwater is not currently used as a potable water source at OU13, (Tetra Tech, 2006b). The main source of potable water for NAS Pensacola is the Navy-owned well field located at NTTC Corry Station, which is located approximately three miles north of NAS Pensacola on the northern (opposite) side of Bayou Grande.

The projected future site use continues to be a cemetery (Tetra Tech, 2006b).

7.3 HISTORY OF CONTAMINATION

Site 8

Analytical data generated by soil quality investigations revealed the presence of cadmium, lead, TRPH, PAH, fluometuron (carbamate, a pesticide), and dieldrin in the soil at OU13, Site 8. The detected concentrations of cadmium and dieldrin exceeded their applicable criteria.

Only cadmium, manganese, and an isolated lead detection exceeded federal and state CTLs and NAS Pensacola background concentrations in groundwater samples collected from Site 8. Antimony exceeded its federal and state CTLs in two groundwater samples; however, there is no NAS Pensacola background concentration for antimony. With the exception of one antimony detection, all exceedances were from monitoring wells located at the north and northeastern portion of the site. This distribution is consistent with past disposal of metallic-alloy aircraft refuse or other metallic material that may lie beneath Building 3561's current location and the site's northern shallow groundwater flow. The extent of shallow groundwater impact does not extend to the farthest down-gradient well at Site 8, as confirmed by no inorganic exceedances of federal and state CTLs in the Phase II groundwater sample from that location. None of the targeted VOCs SVOCs, or PCBs were detected at concentrations that exceed their federal or state CTLs in the Site 8 groundwater.

Site 24

Inorganic soil contaminants identified in samples collected at Site 24 are attributed to application of fertilizer in the immediate area of sample collection. Therefore, as indicated in the ROD no further CERCLA action was deemed necessary.

Concentrations of iron and manganese that have been detected in groundwater samples from the shallow aquifer zone at Site 24 are attributed to fertilizer application, which commonly contains water-soluble forms of these inorganics as essential nutrients. Iron and manganese have been detected at concentrations exceeding their federal and state CTLs.

Metal fragments were found in the subsurface soil north of Building 3678, indicating that Site 8 fill activities extended to, or have been reworked onto Site 24. Based on this evidence, the concentrations of antimony, cadmium, nickel, and thallium exceedances detected in groundwater samples from the shallow aquifer zone are attributed to metal-alloy debris disposal at Site 8 and/or Site 24. Antimony, cadmium, nickel, and thallium have sporadically exceeded their federal and state CTLs. In the RI Addendum investigation, concentrations of aluminum, calcium, iron, magnesium, and sodium concentrations have also exceeded federal and state CTLs and NAS Pensacola background concentrations. Relatively low concentrations of methylene chloride, trichloroethene, and vinyl chloride have also been detected at concentrations that slightly exceeded their federal and state CTLs. The source of these inorganics and organic compounds is suspected to be from past disposal activities at Site 8 and/or Site 24. Pesticides have not been detected in the six down-gradient monitoring wells installed for the RI Addendum investigation. SVOCs and PCBs have not been detected at concentrations above their federal and state CTLs.

7.3.1 Initial Response

As a result of the hazard presented by potential exposure to the identified contaminants, CH2M Hill conducted IRAs at OU13 from June 28, 2004 to August 25, 2005. The objective of the IRA was to remove soil contaminated by COCs from Site 8. Delineation samples were collected and the remedial volume was calculated for the protection of human health and leachability to groundwater SCTLs. Approximately 634 cubic yards of cadmium impacted soil and approximately 429 cubic yards of dieldrin contaminated soil was removed from Site 8. The removal action is described in the IRA Report, Excavation of Contaminated Soil at Operable Unit 13 Site 8 (CH2M Hill, 2004). The backfill material was analyzed for USEPA Contract Laboratory Program Target Compound List and Target Analyte List, and determined to be clean fill.

7.3.2 Basis for Taking Action

A baseline risk assessment was conducted for OU13 during the RI to assess the COCs (inorganic and organic constituents) and the potential for unacceptable risk to human health and environment with regard to specific land use scenarios. Based on unacceptable risk posed by the COCs, a response action was selected in the ROD to protect the public health, welfare, and the environment from actual or threatened releases of the COCs into the environment. Although the baseline risk assessment presented unacceptable risks for both soil and groundwater, an IRA for soil was completed in October 2004 to eliminate the unacceptable risks to human health and leachability of the COCs to groundwater from Site 8 soil.

The extent of impacted media driving the unacceptable excess risk to groundwater at Sites 8 and 24 is limited. The magnitude of this contamination is low relative to most ARARs. This unacceptable excess risk to human health should be qualified based on factors that affect the exposure potential by humans to impacted media at Sites 8 and 24. The shallow groundwater of the surficial zone at both sites is not currently used as a groundwater source due to its poor ambient quality. Because higher quality water sources are available for NAS Pensacola, shallow groundwater is unlikely to be used in the future. These two factors greatly reduce the actual exposure potential to groundwater at Sites 8 and 24. However, because the state of Florida considers all groundwater to be potable, the basis for taking action at OU13 is the presence of COCs in groundwater at concentrations that exceed federal and state drinking water standards. The COCs identified for Sites 8 and 24 are included in Table 7-2.

The concentrations of COCs detected in soil samples collected at Site 24 are not within the USEPA acceptable risk range and the FDEP risk criteria for current workers, trespassers, and future residents (Tetra Tech, 2006b).

Concentrations of contaminants in groundwater were compared against the Florida natural attenuation default source concentrations in Table V of Chapter 62-777 F.A.C. to evaluate the use of natural attenuation as a remedy for groundwater. Contaminants that exceeded the Florida natural attenuation default source concentration criteria were listed as COCs.

TABLE 7-2
OU13 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PEANSACOLA, FLORIDA

Soil	Shallow Groundwater
Aldrin	Antimony
Arsenic	Cadmium
Benzo(b)fluoranthene	Dieldrin
Benzo(a)pyrene	Iron
Dibenzo(a,h)anthracene	Lead
Dieldrin	Manganese
	Methylene Chloride
	Nickel
	Thallium
	Trichloroethene
	Vinyl Chloride

7.4 REMEDIAL ACTIONS

7.4.1 Remedy Selection at OU13

The ROD for NAS Pensacola OU13 was signed by the Navy on September 28, 2006 and by USEPA on October 5, 2006. RAOs were developed based on the data collected during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD. The goals of the remedies selected for soil and groundwater at OU13 are to protect human health and the environment by eliminating, reducing, or controlling hazards posed by the site and to meet ARARs.

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, the Navy selected No Action for soil at OU13 and LUCs with groundwater monitoring to address contamination of groundwater by the COCs at OU13. Both alternatives, once implemented, will be protective of human health and the environment, are cost-effective, and result in permanent solutions to the maximum extent practicable. With the implementation of these alternatives, the site will be protective of human health and the environment. Table 7-3 lists the RAOs for OU13.

TABLE 7-3
OU13 REMEDIAL ACTION OBJECTIVES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PEANSACOLA, FLORIDA

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Soil	Aldrin, Arsenic, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene Dieldrin	Eliminate human health risk above HI=1.
Groundwater	Antimony Cadmium Dieldrin Heptachlor epoxide Iron Lead Manganese Methylene Chloride Nickel Thallium Trichloroethene Vinyl Chloride	Monitor groundwater to ensure COCs are not migrating off-site and institutional controls are maintained.

The remedy was selected for the following reasons:

- Because the removal action was performed, site soil poses no risk.
- The OU13 area is currently used for industrial uses including a paved area for PWC storage and employee parking (Site 8) and buffer zone and cemetery burials in Barrancas National Cemetery (Site 24).
- The projected future site use is consistent with the current uses. Groundwater on site currently exceeds remedial goals. However, natural degradation appears to be occurring and there is no evidence of contaminant migration off-site. Furthermore, the surficial aquifer is not likely to be used for potable water due to its low quality. Source control remediation will address restricting exposure to contaminated groundwater.

Source control shall include LUCs which will be used to restrict groundwater use of the surficial zone of the sand and gravel aquifer on site. A Remedial Design for Land Use Controls and Groundwater Monitoring at OU 13 (Tetra Tech, 2008a) was prepared as the land use component of the Remedial Design. In accordance with the Site Management Plan and the NAS Pensacola FFA, the LUCRD contains LUC implementation and maintenance actions, and periodic inspections by the USEPA and FDEP. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for the remedial integrity.

The following components constitute the remedial action for OU13 to address the groundwater RAO:

- Performing groundwater monitoring to ensure the COCs are not moving off-site.
- Conducting reviews to determine whether groundwater performance standards continue to be appropriate.
- Implementing institutional controls to restrict use of groundwater from the surficial zone of the sand and gravel aquifer within 300 feet of the site.
- Reviewing the institutional controls and certification in order to determine if they should remain in place or be modified to reflect changing site conditions.

7.4.2 Remedy Implementation at OU13

The OU13 ROD specified removal of isolated hot spot areas of soil impacted by the COCs to reduce the potential for direct exposure. Approximately 634 cubic yards of dieldrin-impacted soil were removed from the eastern side of Building 3561 and approximately 429 cubic yards of cadmium-impacted soil were also removed from the western side of Building 3561. All soil with dieldrin and cadmium at concentrations exceeding their respective remedial goals of 0.004 mg/kg, and 0.005 µg/L, respectively were removed. The Groundwater Monitoring Plan has been approved and groundwater monitoring has been initiated. Total remediation cost expended to date for this project is $83,996.

7.4.3 System O&M at OU13

The costs for the selected remedy does not included O&M.

7.4.4 Long-Term Groundwater Monitoring at OU13

In November 2007, the Navy began long-term groundwater monitoring for OU13. Semiannual sampling events were conducted in November 2007, May 2008, October 2008, May 2009, June 2009, April 2010, July 2010, March 2011, October 2011, and January 2012.

As stated in the ROD for OU13 (Tetra Tech, 2006b), the Navy's original 2006 cost estimate for implementation of remedial action and closure of OU13 and 30 years of LTM program (risk-reduction) was $610,200. The approximate cost to date for remedial actions including O&M and monitoring at OU13 is $83, 996.

7.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the second Five-Year Review since the OU13 ROD was signed. No issues were identified during the Five-Year Review process and the remedy was found to be protective.

7.5.1 Protectiveness Statements from the Last Review

Based on the results of the 2008 Five-Year Review, the remedy was expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through natural attenuation.

7.5.2 Status of Recommendations and Follow-up Actions from Last Review

No recommendations or follow up actions were identified during the previous Five-Year Review.

7.6 FIVE-YEAR REVIEW PROCESS

This is the second Five-Year Review for this site. Members of the NAS Pensacola Partnering Team were notified of the initiation of the Five-Year Review in January 2012. The Five-Year Review was led by Gerald Walker of Tetra Tech, the NAVFAC SE Navy CLEAN Contractor, and included other Tetra Tech staff. Patty Marajh-Whittemore of NAVFAC SE, Greg Campbell of NAS Pensacola Public Works Department, Tim Woolheater of USEPA, David Grabka of FDEP, and Sam Naik of CH2M Hill assisted in the review.

The review included the following components:

- Document Review
- Data Review
- Site Inspection
- Five-Year Review Report development and review

7.6.1 Document Review

This Five-Year Review consisted of a review of relevant documents including the ROD, IRA Report, Draft LUCRD, Natural Attenuation Monitoring Reports and applicable federal and state statutes.

7.6.2 Data Review

7.6.2.1 Review of COC Data for Groundwater

Since the initial ROD was signed, five years of semiannual monitoring and sampling have occurred. The COCs for groundwater established for Site 8 in the ROD are: antimony, cadmium, iron, lead, manganese nickel, and thallium.

Antimony, cadmium and manganese have exceeded their respective Florida CTLs in groundwater samples collected during every sampling event since the inception of the groundwater monitoring. One lead exceedance was detected during the November/December 2007 sampling event at a single one monitoring well, PEN-43-13S.

The groundwater at Site 8 was evaluated in light of the changes in the number of monitoring well locations with contaminants that exceed CTLs, and the changes in contaminant concentrations in individual monitoring wells with time. The trend analysis for the COCs for groundwater at NAS Pensacola was performed using the Mann-Kendall test (ProUCL Version 4.1.00 [Lockheed Martin Environmental Services, 2010]) at a 95 percent confidence level and groundwater sample data collected from 2007 to 2011 (Appendix G). The Mann-Kendall test is used because it does not assume any particular distributional form and accommodates values below the detection limit by assigning them a common value.

During the November and December 2007 groundwater sampling events, 12 monitoring wells were sampled and the groundwater was analyzed for the 11 groundwater COCs. Only three of the COCs detected in the groundwater samples exceeded their respective Florida CTLs. Cadmium, iron, and manganese were the only metals that exceeded their Florida CTLs. VOCs and pesticides were not detected in the 2007 sampling event.

During the April and October 2008 groundwater sampling events, 12 monitoring wells were sampled and the groundwater was analyzed for the 11 groundwater COCs. Only five of the COCs detected in the groundwater samples exceeded their respective Florida CTLs. Antimony, cadmium, iron, and manganese were the only metals that exceeded their Florida CTLs. Bromodichloromethane was the only VOC that exceeded its CTL. Pesticides were not detected in the 2008 sampling event.

During the March and October 2009 groundwater sampling events, 12 monitoring wells were sampled and the groundwater was analyzed for the 11 groundwater COCs. Only three of the COCs detected in the groundwater samples exceeded their respective Florida CTLs. Cadmium, iron, and manganese were the only metals that exceeded their Florida CTLs. VOCs and pesticides were not detected in the 2009 sampling event.

During the March and October 2010 groundwater sampling events, 12 monitoring wells were sampled and the groundwater was analyzed for the 11 groundwater COCs. Only five of the COCs detected in groundwater samples exceeded their respective Florida CTLs. Antimony, cadmium, iron, and manganese were the only metals that exceeded their Florida CTLs. Bromodichloromethane was the only VOC that exceeded its CTL. Pesticides were not detected in the 2010 sampling event.

During the October 2011 groundwater sampling event, 10 monitoring wells (24GS02R was not sampled due to an obstruction) were sampled and the groundwater was analyzed for the 11 groundwater COCs. Only three of the COCs detected in the groundwater samples exceeded their respective Florida CTLs. Cadmium, iron, and manganese were the only metals that exceeded their Florida CTLs. VOCs and pesticides were not detected in the 2009 sampling event.

The data collected during the 2007, 2008, 2009, 2010, and 2011 groundwater sampling events were evaluated to identify observable trends. Trend analysis results are provided in Appendix G. For metals, in general, cadmium demonstrated no or increasing trends, antimony and iron demonstrated no or decreasing trends, and lead and manganese demonstrated no trends. For VOCs, in general, no trends were observed and pesticides were not detected.

7.6.2.2 LUC Inspections

LUC inspections were conducted annually at OU13 during the period under review. There were no issues identified during annual inspections. The annual inspections are presented in Appendix H.

7.6.3 <u>Site Inspection and Interviews</u>

Inspections at the site were conducted on May 3, 2012 by Tetra Tech personnel. The purpose of the inspection was to assess the protectiveness of the remedy, including the presence of fencing to restrict access and condition of monitoring wells. Since surficial soil with contaminant concentrations above the remedial goal were removed, fencing the site was not warranted. Monitoring wells were accessible and appeared to be in good condition. Therefore, no apparent deficiencies noted during the site inspection.

The institutional controls that are in place include the restriction of groundwater use of the surficial zone of the sand and gravel aquifer underlying the sites. At the time of the inspection, institutional controls were found to be adequate, and use of groundwater was not observed. Roadways within OU13 appeared adequate, and there were no apparent signs of vandalism or trespassing.

An interview was conducted with Greg Campbell, Environmental Engineer for NAS Pensacola, on May 2, 2012. According to the interview, Mr. Campbell indicated he is well informed about the site's activities and progress, and was not aware of any community concerns regarding the site or its operation, or of any incidents such as vandalism, trespassing or emergency responses at the site. The interview forms are presented in Appendix H.

Mr. Campbell indicated annual LUC inspections are performed. In addition, complaints, violations, or other incidents related to the site requiring a response by his office have not occurred. Mr. Campbell indicated closure of the iron recovery system is appropriate.

7.6.4 ARAR Level Changes

The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Safe Drinking Water Act MCLs (40 CFR 141.11–141.16)
- Safe Drinking Water Act MCLs (40 CFR 141.50–141.51)
- Florida Drinking Water Standards, Monitoring and Reporting, Chapter 62-550, F.A.C.
- Florida Cleanup Target Levels, Chapter 62-777, F.A.C.
- Contaminated Site Cleanup Criteria, Chapter 62-780, F.A.C.
- Ground Water Classes, Standards, and Exemptions, Chapter 62-520, F.A.C.

With the exception of Chapter 62-777, F.A.C., there have been no changes in the MCLs, MCLGs, Florida Drinking Water Standards, Florida Ground Water Classes, Florida GCTLs, and Florida Site cleanup requirements that affect the protectiveness of the remedy.

There are no location-specific or action-specific ARARs identified in the ROD.

The cadmium and dieldrin contaminated areas were removed in 2004. The cleanup criteria used in Site 8 IRA for cadmium and dieldrin were based on their SCTLs that were in effect prior to the revision of Chapter 62-777, F.A.C. in 2005. In the 2005 revision, the industrial direct exposure SCTL for cadmium increased from 1,300 to 1,700 mg/kg, and the leachability to Groundwater SCTL decreased from 8 to 7.5 mg/kg. The industrial direct exposure SCTL for dieldrin remained the same at 0.3 mg/kg, but the leachability to groundwater SCTL decreased from 0.004 to 0.002 mg/kg. Because the industrial direct exposure SCTL criterion for cadmium increased and industrial direct exposure SCTL for dieldrin criterion remained the same, the remedy remains protective in the short- and long-term for both COCs. However, the leachability to groundwater SCTLs for cadmium and dieldrin have decreased, so there may be slightly less protectiveness. Also, it should be noted that dieldrin has not been detected in a groundwater sample since 2007 (monitoring well 08GR01R); therefore, the change in the leachability to groundwater SCTL for dieldrin may be inconsequential.

7.7 TECHNICAL ASSESSMENT

7.7.1 Question A: Is the remedy functioning as intended by the ROD?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD.

Health and Safety Plan/Work Plan*:* A Site specific Health and Safety Plan (HASP) and Groundwater Monitoring Work Plan has been developed.

Remedial Action Performance: Contaminated soil was removed from Site 8 and replaced with clean backfill. The Groundwater Monitoring Plan for OU13 has been approved and natural attenuation monitoring has been initiated.

System O&M*:* There are no active remediation systems at OU13 and therefore no system O&M is required.

Cost of System Operations/O&M*:* There are no active remediation systems at OU13 and therefore no system O&M is required.

Opportunities for Optimization*:* Optimization of the groundwater monitoring effort was completed.

Early Indications of Potential Remedy Failure*.* No indicators of potential remedy failure have been identified.

Implementation of Institutional Controls and Other Measures: The Remedial Design outlining the site specific LUCIP has been completed and complies with the LUCAP agreement between the Navy, USEPA, and FDEP. OU13, Sites 8 and 24 will be available for industrial use, but residential use of the site would be prohibited. The Navy will be required to conduct periodic site inspections and ensure that the proposed LUCs are being properly maintained and administered. Groundwater use of the surficial zone of the sand and gravel aquifer in the immediate vicinity of OU13 is prohibited. The Navy will conduct an annual review of the institutional controls and certify that the controls should either remain in place or be modified to reflect changing site conditions.

7.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure Assumptions: There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes to Standards and To Be Considered: ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes to standards since the remedy was implemented. The industrial direct exposure SCTL for cadmium increased from 1,300 to 1,700 mg/kg, and the leachability to Groundwater SCTL criteria decreased from 8 to 7.5 mg/kg. The leachability to groundwater SCTL for dieldrin decreased from 0.004 to 0.002 mg/kg. For groundwater, there have been no changes that affect the protectiveness.

Changes in Exposure Pathways: No changes in the site conditions or land use that affect exposure pathways were identified as part of the Five-Year Review. Exposure to the site groundwater is still restricted by institutional controls.

Changes in Toxicity and Other Contaminant Characteristics: There have been no changes in human health or ecological toxicity criteria that would impact protectiveness of the remedy.

Changes in Risk Assessment Methodologies: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

7.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has come to light that calls into question the protectiveness of the remedy.

7.8 ISSUES

No issues regarding OU13 were discovered during the Five-Year Review.

7.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that natural attenuation monitoring continue at OU13.

7.10 PROTECTIVENESS STATEMENT

The selected remedy for OU13 is protective of human health and the environment.

8.0 OPERABLE UNIT 18

The OU18 ROD was signed on April 12, 2010. Implementation of remedial action at Site 43 began in 2001. This five-year review consists of data collected since the ROD was signed and provides a status update for Site 43 – Demolition Debris Disposal Area. This statutory review for Site 43 is being conducted because contaminated wastes are still contained on site and do not allow for UU and UE.

8.1 SITE CHRONOLOGY

A list of significant Site 43 historical events and relevant dates is provided in Table 8-1.

**TABLE 8-1
OU18 CHRONOLOGY
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA**

Event	Date
Child using a metal detector discovered a partially exposed drum east of the tennis courts	1992
Site Reconnaissance	December 1992
Geophysical Investigation	1994
Site Characterization Sampling	1999
Interim Remedial Action	2001
RI	2005-2006
FS	2008
Proposed Plan	2008
Final ROD Issued	2010
LUCRD Approved	March 2011
Remedial Design Approved	November 2011

8.2 BACKGROUND

8.2.1 Physical Characteristics of Site 43

OU18, also referred to as Site 43, encompasses approximately 180,000 square feet (4.1 acres), approximately 40,000 of which are covered by a paved parking lot (see Figure 8-1). The remainder of the site is an open grassy area covered with scattered trees. Site 43 is located in a developed area in the eastern portion of NAS Pensacola, at the southwestern corner of Murray and Taylor Roads and north of BOQ Road, which provides access to the Officer's Quarters. The site is on the eastern slope of a shallow closed depression, bound by paved roads on all four sides. Surface water features are not present at the site, and overland runoff flows west into the depression. A designated wetland and drainage ditch located approximately 500 feet east of the site are the nearest surface water bodies.

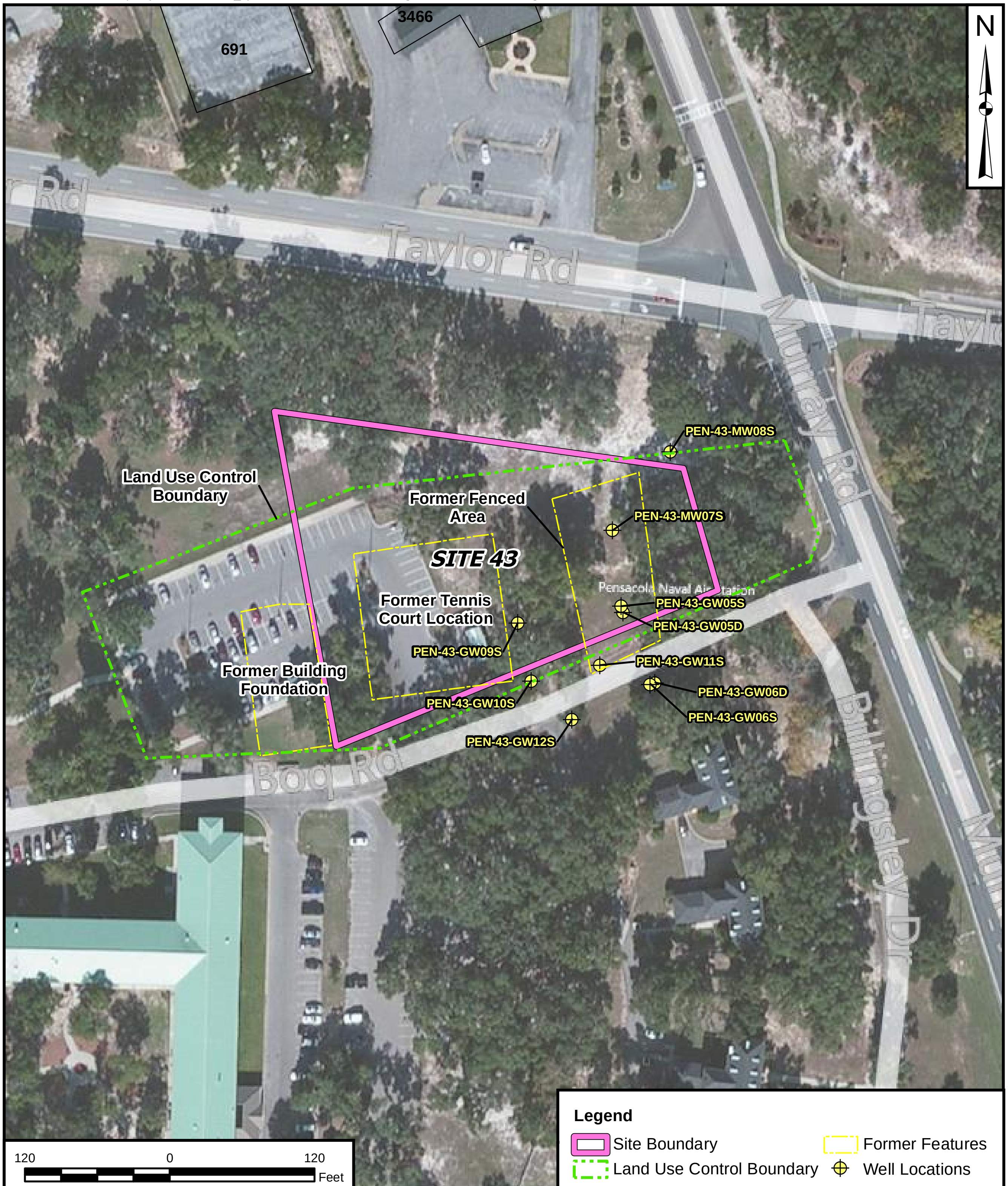
Soil at Site 43 consists of fine to coarse excessively drained sands formed in sandy marine environments and characterized by rapid infiltration and slow runoff. Overburden materials encountered at Site 43 during the RI were typical of regional undifferentiated Pleistocene marine deposits made up of light brown to tan fine quartz sand with associated stringers and lenses of gravel and clay. From the ground surface to 4 feet bls, many areas of the site showed signs of disturbance either from waste disposal or 2001 IRA excavation activities. Below 4 feet, typical lithologies included medium to fine silty or clayey sand ranging from light gray or tan to dark brown in color. Significant clay or gravel horizons were not encountered. Regionally, overburden thickness ranges from approximately 30 to 800 feet; bedrock was not encountered during investigations at Site 43. Depths to groundwater ranged from approximately 12 to 16 feet bls during the RI, and groundwater flow was generally to the east.

8.2.2 Land and Resource Use at Site 43

The site previously contained a tennis court and building foundation/basketball court; however, the tennis and basketball courts were removed in 2003. Prior to the most recent use as a recreational area, site use is unknown.

Recreational users and maintenance workers use the site currently and are expected to continue use into the foreseeable future. On-site wildlife may temporarily use Site 43, but due to lack of suitable cover, wildlife use is assumed to be infrequent. The NAS Pensacola Base Master Plan identifies the planned future use of the site as open space, indicating no future development or construction activities are planned for the site. If future land use at Site 43 differs from the reasonably anticipated land use, the Navy will reassess risks appropriate to the future use.

P:\112G02722\GIS\maps\5yrFormatted\AP_5yearReviewOU18Site43.mxd [alex.montalvo 6/5/2012]



DRAWN BY	DATE		CONTRACT NUMBER	CTO NUMBER
GIS	6/5/2012	SITE MAP - OPERABLE UNIT 18	112G00702	067
CHECKED BY	DATE	5 YEAR REVIEW	APPROVED BY	DATE
A.I.	6/5/2012	NAS PENSACOLA		
REVISED BY	DATE	PENSACOLA, FLORIDA	APPROVED BY	DATE
SCALE AS NOTED		NAVFAC	FIGURE NO. 8 - 1	REV 0

The nearest water supply well to Site 43 is located approximately 1,600 feet west-southwest; however it is no longer used. The main source of potable water for NAS Pensacola is the Navy-owned well field located at NTTC Corry Station, which is located approximately three miles north of NAS Pensacola on the northern (opposite) side of Bayou Grande.

8.3 HISTORY OF CONTAMINATION

Environmental investigations at Site 43 began in December 1992 when a child using a metal detector discovered a partially exposed drum east of the tennis court, and subsequent site reconnaissance identified additional drums and smaller rusted metallic debris in the area. Odors, visible soil stains, or other indications of contaminant release were not observed. The area surrounding the drums was fenced to prevent general access until further investigations could be conducted. The precise locations of the debris disposal areas were unknown; however, approximate locations of several disposal areas were determined based on the results of subsequent investigations.

8.3.1 Initial Responses at Site 43

A Geophysical Investigation was conducted in 1994 to assess the size of the disposal area and number of drums buried in the area. A total of 25 geophysical anomalies were identified during the investigation, but the actual number of drums disposed in the area was not determined. After the Geophysical Investigation, it was recommended that the drum disposal area and several anomalies outside of the disposal area be further investigated through the use of test pits or trenches.

Site characterization sampling was conducted in 1999 and included surface and subsurface soil sampling from anomalous locations identified through the use of test pits and groundwater sampling from temporary micro wells. Drums with sufficient contents were sampled and were found to contain PAHs at concentrations exceeding Florida residential direct exposure SCTLs and metals at concentrations exceeding residential and industrial direct exposure SCTLs. Concentrations of benzo(a)pyrene, antimony, arsenic, barium, copper, iron, and vanadium exceeded Florida residential direct exposure SCTLs. Concentrations of arsenic and lead exceeded Florida residential direct exposure SCTLs. Fourteen drums were removed during the course of the investigation.

Samples of surface soil, subsurface soil (beneath the drum disposal depth), and soil just above the water table were collected during this investigation. Concentrations of benzo(a)pyrene, antimony, arsenic, barium, copper, iron, zinc, lead, nickel, and vanadium in surface and shallow subsurface soil samples exceeded Florida residential direct exposure SCTLs. Leachability to groundwater SCTLs were exceeded in the surface soil samples by antimony and nickel. Leachability to groundwater SCTLs were exceeded in the subsurface soil samples by antimony, arsenic, barium, nickel, and zinc.

Groundwater samples contained iron and aluminum at concentrations that exceeded their federal and state CTLs.

An IRA to remove metal debris and contaminated surface and subsurface soil was recommended. The IRA was conducted in 2001 and included removal of 657 cubic yards of soil and debris including 20 to 25 rusted metal drums and drum parts and inert ornamental ordnance and munitions. Prior to the IRA, remedial goals were developed for some COCs using 95 percent upper confidence limits (UCLs) for surface soil. COC concentrations in surface and subsurface soil samples collected prior to excavation were compared to these remedial goals to determine the extent of contamination requiring removal. Remedial goals were re-evaluated and revised after excavation activities were completed, and it was determined that additional areas of contaminated soil required excavation. Based on this information, the IRA Report recommended an RI and FS.

8.3.2 Basis for Taking Action at Site 43

Arsenic, barium, copper, vanadium, and carcinogenic PAHs (cPAHs) were detected in surface and subsurface soil at concentrations exceeding Florida's residential risk-based criteria, and cPAHs and lead were detected at concentrations exceeding Florida's industrial risk-based screening criteria and site-specific recreational criteria. Unacceptable risks were identified for residential and non-residential exposure to lead in soil and groundwater at Site 43. Because risks were identified under the current and reasonably anticipated future land use scenario (non-residential), it was determined that a response action was necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment that may present an imminent and substantial endangerment to public health or welfare. COCs related to each medium are summarized in Table 8-2.

TABLE 8-2
OU18 CONTAMINANTS OF CONCERN
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Soil	Groundwater
Arsenic	Lead
Barium	
Copper	
Lead	
Vanadium	
cPAHs	

8.4 REMEDIAL ACTIONS

8.4.1 Remedy Selection at Site 43

The ROD for NAS Pensacola Site 43 was signed in March 2010. RAOs were developed as a result of data collected during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD.

The goals of the selected soil and groundwater remedies at Site 43 are to protect human health and the environment by eliminating, reducing, or controlling hazards posed by the site and to meet ARARs. Based on consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives, and any comments received from USEPA, FDEP, and the public, excavation and off-site disposal of the most contaminated soil (in unpaved areas) to meet industrial SCTLs; groundwater monitoring; and LUCs to prohibit future residential use, to ensure maintenance of paved areas, and prohibit groundwater use were selected to address contamination at Site 43. Table 8-3 lists the RAOs for Site 43.

**TABLE 8-3
OU18 REMEDIAL ACTION OBJECTIVES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA**

Medium	COCs	Remedial Action Objectives
Soil	Arsenic, Barium, Copper, Lead, Vanadium, and cPAHs.	Prevent unacceptable human health risk associated with exposure to soil containing concentrations greater than Florida's SCTLs.
Groundwater	Lead	Prevent unacceptable human health risk associated with exposure to groundwater containing concentrations greater than the Florida's CTL and USEPA Action Level.

Four soil remedial alternatives and three groundwater remedial alternatives were evaluated in the OU18 FS to address the two RAOs. The selected remedy for Site 43 included limited soil excavation and off-site disposal to meet industrial SCTLs, LUCs, and long-term groundwater monitoring. These soil and groundwater alternatives were selected because they provide the best balance of tradeoffs with respect to the nine CERCLA remedy selection evaluation criteria and will allow for continued non-residential use of the property. The following components, as provided in the Site 43 ROD, constitute the remedial action for Site 43 to address the soil and groundwater RAOs:

- Excavation and off-site disposal of the most contaminated soil (in unpaved areas) to meet industrial SCTLs.

- Collecting and analyzing groundwater samples from four monitoring wells, one existing well and three new downgradient wells, quarterly for one year for analysis of lead. After one year, data will be evaluated to determine future monitoring requirements. Additional groundwater samples will be collected in the area around the existing monitoring well (PEN-43-13S) with the lead CTL exceedance to confirm the extent of the groundwater contamination and to provide direction for installation of the new downgradient wells. Other existing permanent monitoring wells may periodically substitute for the downgradient monitoring wells to verify that contamination has not appeared elsewhere in groundwater at the site.

The ROD also states that: "The Selected Remedy includes 1 year of groundwater monitoring followed by a re-evaluation of conditions. Any modifications to the LUCs to be implemented for groundwater based on such a reevaluation(s) will be made in accordance with the provisions of the LUCRD for Site 43."

- LUCs will be implemented within the Site 43 boundaries to:

  - Prohibit residential use of the site, including housing, child-care facilities, schools, playgrounds, convalescent, or nursing care facilities.

  - Prohibit unauthorized excavation and/or removal of soil with contaminant concentrations exceeding Florida residential SCTLs.

  - Prohibit all uses of groundwater from the surficial aquifer underlying the site.

  - Maintain the integrity of the paved areas.

  - Maintain the integrity of existing or future monitoring or remediation systems.

The ROD states that "With regard to soil, because metals contamination does not readily attenuate through natural processes, the LUCs to preclude residential use of the site will need to remain in effect for the foreseeable future unless more active remedial measures are undertaken to allow for future unrestricted site use."

The key factors in the selection of this remedy were as follows:

- The remedy is consistent with the reasonably anticipated future non-residential use of the site and will allow continued use of the parking area without disturbance of the pavement.

- The remedy achieves similar protection at a significantly lower cost less than full-scale removal to achieve unrestricted use and unlimited exposure ($390,000 compared to $706,000).

- Because it is expected that, with the removal of the soil source, lead in groundwater may rapidly decrease to concentrations less than the Florida CTL and USEPA Action Level, and because long-term LUCs will be required to prevent residential development and ensure maintenance of pavement, the inclusion of a groundwater use restriction was not additionally burdensome.

8.4.2 Remedy Implementation at Site 43

A revised final LUCRD was submitted by the Navy in November 2011 and the approved by the regulatory agencies in December 2011. The Navy continues to prepare the UFP-SAP and Remedial Action Work Plan and anticipates submittal of the documents in July 2012.

8.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

8.5.1 Protectiveness Statements from the Last Review

This is the first Five-Year Review since the approval of the ROD; therefore, no previous protectiveness statement is available.

8.5.2 Status of Recommendations and Follow-up Actions from Last Review

This is the first Five-Year Review since the approval of the ROD; therefore, there are no follow-up actions.

8.6 FIVE-YEAR REVIEW PROCESS

This is the first Five-Year Review for this site. Members of the NAS Pensacola Partnering Team were notified of the initiation of the Five-Year Review in January 2012. The Five-Year Review was led by Gerald Walker of Tetra Tech, the NAVFAC SE Navy CLEAN Contractor, and included other Tetra Tech staff. Patty Marajh-Whittemore of NAVFAC SE, Greg Campbell of NAS Pensacola Public Works Department, Tim Woolheater of USEPA, David Grabka of FDEP, and Sam Naik of CH2M Hill assisted in the review.

The review included the following components:

- Document Review
- Data Review
- Site Inspection
- Five-Year Review Report development and review

8.6.1 Document Review

This five-year review consisted of a review of relevant documents including the ROD and RI, and applicable federal and state statutes

8.6.2 Data Review

Source removal and groundwater monitoring are pending submittal and approval of the UFP-SAP and Remedial Action Work Plan.

8.6.3 Site Inspection and Interviews

LUC inspections were conducted annually at OU18 during the period under review. The inspections noted no problematic observations. Copies of the annual certifications are provided in Appendix I.

8.6.4 Site Inspection and Interviews

An inspection was conducted at the site on May 2, 2012 by Tetra Tech personnel. The purpose of the inspection was to assess the protectiveness of the remedy.

The institutional controls that are in place include the restriction of land use, restriction of all groundwater use, prohibition of excavation of areas with contaminated soils without prior approval from the NAS Pensacola Environmental Office, maintenance of the paved parking lot, and maintenance of all existing or future monitoring and on-site remedy components. At the time of the inspection, institutional controls appeared to be adequate, and use of groundwater was not observed. Roadways within OU18 appeared adequate, and there were no apparent signs of vandalism or trespassing. Existing monitoring wells were accessible and in good condition. Signage is in place restricting access to the site as contaminated soils remain in place. No deficiencies were noted during the site inspection.

An interview was conducted with Greg Campbell, Environmental Engineer for NAS Pensacola, on May 2, 2012. According to the interview, Mr. Campbell indicated he is well informed about the site's activities and progress, and was not aware of any community concerns regarding the site or its operation, or of any incidents such as vandalism, trespassing or emergency responses at the site. The interview forms are presented in Appendix I.

Mr. Campbell indicated annual LUC inspections are performed. In addition, complaints, violations, or other incidents related to the site requiring a response by his office have not occurred.

8.6.5 ARAR Level Changes

The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Lead and Copper Rule Federal Register 26564
- Safe Drinking Water Act MCLs (40 CFR 141.11–141.16)
- Safe Drinking Water Act MCLs (40 CFR 141.50–141.51)
- Florida Drinking Water Standards, Monitoring and Reporting, Chapter 62-550, F.A.C.
- Florida Cleanup Target Levels, Chapter 62-777, F.A.C.
- Ground Water Classes, Standards, and Exemptions, Chapter 62-520, F.A.C.

There have been no other changes in the Lead and Copper Rule, Chapter 62-777, F.A.C., and Chapter 62-550, F.A.C. that affect the protectiveness of the remedy. The soil cleanup goals in the ROD are the same as those in Chapter 62-777, F.A.C. The 15 µg/L Action Level for lead per the Federal Safe Drinking Water Act and Chapter 62-550, F.A.C. has not changed.

The following standards were identified as action-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- RCRA Regulations, Identification and Listing of Hazardous Wastes (40 CFR Part 262.11 and 264.13(a)(1))
- RCRA Regulations, Land Disposal Restrictions for Contaminated Soil (40 CFR Part 268.49)
- Florida Contaminated Site Cleanup Criteria - Risk Management Option Level II, Chapter 62-780.680(2), F.A.C.
- Florida Natural Attenuation with Monitoring Regulation, Chapter 62-780.690(8)(a) thru (c), F.A.C.
- Florida Water Well Permitting and Construction Requirements, Chapter 62-532.500, F.A.C.
- Florida Hazardous Waste – Requirements for Remedial Action, Chapter 62-730.225(3), F.A.C.

The soil excavation and monitoring program have not been implemented, so most of these ARARs were not evaluated. The sections covering General Provisions for Water Well Permitting and Construction and Abandonment of Water Wells in 62-532, F.A.C. were repealed October 7, 2010. Monitoring well installation and abandonment are now addressed in the FDEP Monitoring Well Design and Construction Guidance Manual, 2008.

There are no location-specific ARARs identified in the ROD.

8.7 TECHNICAL ASSESSMENT

8.7.1 Question A: Is the remedy functioning as intended by the ROD?

The remedy has not yet been implemented. The LUCRD was approved in December 2011 and the Remedial Design was approved in December 2011. Approval of the Remedial Action Work Plan is anticipated in August 2012.

Remedial Action Performance: Once implemented, the remedy is expected to perform as designed.

System O&M: There are no active remediation systems at Site 43 and therefore no system O&M is required.

Cost of System Operations/O&M: There are no active remediation systems at Site 43 and therefore no system O&M is required.

Early Indications of Potential Remedy Failure: None.

Implementation of Institutional Controls and Other Measures: The LUCRD was approved in March 2011. Based on the site inspection performed on May 2, 2012, institutional controls have been implemented and are adequate for the site.

8.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure Assumptions: There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes to Standards and To Be Considered: ARARs and TBCs considered during preparation of the ROD were reviewed to determine changes to standards since the remedy was implemented. For soil and groundwater, there are no changes to the cleanup goals identified in the ROD.

Because the remedy has not been implemented yet, the action-specific ARARs could not be evaluated.

Changes in Exposure Pathways: No changes in the site conditions or land use that affect exposure pathways were identified as part of the five-year review. Exposure to the site groundwater is still restricted by the institutional control.

Changes in Toxicity and Other Contaminant Characteristics: There have been no changes in human health or ecological toxicity criteria that would impact protectiveness of the remedy.

Changes in Risk Assessment Methodologies: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

8.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has come to light that calls into question the protectiveness of the remedy.

8.8 ISSUES

Issues were discovered during the Five-Year Review and are noted in Table 8-4.

TABLE 8-4
OU18 ISSUES
FIVE-YEAR REVIEW
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

Issues	Affects Protectiveness (Y/N)	
	Current	Future
Once the remedy is implemented as intended in the ROD and ROD Amendment, the remedy will be protective for the long term. The remedy is protective in the short term as LUCs are being implemented.	N	Y

8.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Approval of the Remedial Action Work Plan must be completed and prior to remedy implementation.

8.10 PROTECTIVENESS STATEMENT

The remedy is expected to be protective of human health and the environment upon excavation and off-site disposal of the most contaminated soil, implementation of groundwater monitoring, and implementation of LUCs to limit exposure to remaining contaminated soils and groundwater. The remedy is protective in the short term as LUCs are currently being implemented and signs are posted restricting access to the site.

9.0 BASEWIDE CONCLUSIONS

This Five-Year Review shows that the Navy is meeting the requirements of the RODs for OUs 3, 4, and 13. In addition, the Five-Year Review shows the remedies for OUs 1, 2, 11, and 18 remain protective in the short term based on implementation of institutional controls, and will be protective upon remedy implementation and completion.

REFERENCES

Aerostar, 2008a. Third Quarter, Year 2008 Monitoring Report Operable Unit 04, Site 15, Pesticide Rinsate Disposal Area, Naval Air Station Pensacola, Florida. Prepared for Naval Facilities Engineering Command Southeast, Jacksonville, Florida. September.

BEI (Bechtel Environmental, Inc.), 1999a. Final Remediation Work Plan/Remedial Design for Phase I, Operable Unit 1, Groundwater Treatment and Recovery System, NAS Pensacola, Pensacola, Florida. April.

BEI, 1999b. Long-Term Groundwater Monitoring Plan for Phase II Remedial Action, Operable Unit 1, NAS Pensacola, Pensacola, Florida. July.

CH2MHill (CH2MHill, Inc.), 2003. Groundwater Monitoring Plan for Operable Unit 4, Site 15, NAS Pensacola, Florida.

CH2MHill, 2004. Interim Removal Action Report, Excavation of Contaminated Soil at OU 13, Site 8.

CH2MHill, 2006. Interim Remedial Action report for Operable Unit 4, Site 15, NAS Pensacola, Florida.

DON (Department of Navy), 2011, Letter from J.P. Quinn, Energy and Environmental Readiness Division, Commander Naval Facilities Engineering Command, Subject: Policy for Conducting Five-Year Reviews. June 7, 2011

E&E (Ecology & Environment, Inc.), 1991. Interim Data Report, Contamination Assessment/Remedial Activities Investigation Waterfront Sediments (Site 2), Naval Air Station Pensacola, Florida. Volumes I and II.

E&E, 1992. Phase I Remedial Investigation Report *for* Operable Unit 11, NAS Pensacola, Florida.

EnSafe (EnSafe/Allen & Hoshall), 1996a, Final Remedial Investigation, Site 1, NAS Pensacola, Florida, January.

EnSafe, 1996b. Remedial Investigation Report, Naval Air Station Pensacola, Site 2.

EnSafe, 1997*.* Final Remedial Investigation Report, OU4 Site 15, NAS Pensacola, Florida. December.

REFERENCES (Continued)

EnSafe, 1998, Final Record of Decision for Operable Unit 1, NAS Pensacola, Florida.

EnSafe, 1999. Final Record of Decision, Operable Unit 4, NAS Pensacola, Florida. November.

EnSafe, 2004. Final Remedial Investigation Report Addendum, Naval Air Station Pensacola, Florida Site 2. March 29.

EnSafe, 2004. Final Feasibility Study Report Addendum, Naval Air Station Pensacola, Florida. October 1.

EnSafe, 2005a. Final Record of Decision Operable Unit 11 (Site 38), NAS Pensacola, Florida. May.

EnSafe, 2005b. Final Record of Decision, Operable Unit 3, Site 2 – Waterfront Sediments, NAS Pensacola, Florida. September.

Geraghty and Miller, Inc., 1984. *Verification Study, Assessment of Potential Ground-Water Pollution,* NAS, Pensacola., Florida.

Geraghty and Miller, Inc., 1986. *Characterization Study. Assessment of Potential Groundwater Pollution at Naval Air Station*, Pensacola, Florida.

ITRC (Interstate Technology and Regulatory Council) Wetlands Team, 2003. Technical and Regulatory Guidance Document for Constructed Treatment Wetlands, http://www.itrcweb.org/WTLND-1.pdf

Lockheed Martin Environmental Services. 2010. ProUCL Version 4.1.00 Technical Guide (Draft) Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA/600/R-07/041 (May)

NEESA (Naval Energy and Environmental Support Activity), 1983. Initial Assessment Study of Naval Air Station, Pensacola, Pensacola, Florida.

NEESA Records, 1985. Operable Unit 11, NAS Pensacola, Florida.

Tetra Tech, 2006a. Record of Decision (Revision 3), Operable Unit 11, NAS Pensacola, Florida. Prepared for Naval Facilities Engineering Command, Southeast, North Charleston, South Carolina. August.

REFERENCES (Continued)

Tetra Tech, 2006b. Record of Decision (Revision 3), Operable Unit 13, NAS Pensacola, Florida. Prepared for Naval Facilities Engineering Command, Southeast, North Charleston, South Carolina. August.

Tetra Tech, 2006c. 5th Annual Monitoring Report for Long-Term Monitoring Operable Unit 1, Prepared for Naval Facilities Engineering Command, Southeast, North Charleston, South Carolina. November.

Tetra Tech, 2008a. Remedial Design for Land Use Controls and Groundwater Monitoring at Operable Unit 13, Site 8 – Rifle Range Disposal Area and Site 24 – DDT Mixing Area, Naval Air Station Pensacola, Florida. August.

Tetra Tech, 2008b. Record of Decision Operable Unit 2, Naval Air Station Pensacola, Florida. Prepared for Naval Facilities Engineering Command, Southeast, Jacksonville FL. September.

Tetra Tech, 2010. Long-Term Groundwater Monitoring Operable Unit 1 – Site 1 Sanitary Landfill, NAS Pensacola, Pensacola, Florida. (July)

Tetra Tech, 2011. Confirmatory Sampling Letter Report for Operable Unit 11, Site 38, Naval Air Station Pensacola, Florida, Prepared for Naval Facilities Engineering Command Southeast, Jacksonville, Florida. June 17, 2011

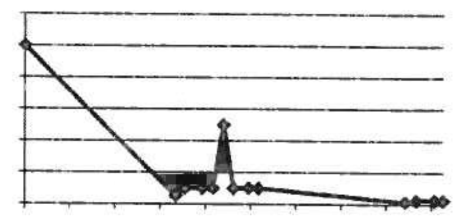
Tetra Tech, 2011. 2010 Annual Monitoring Report for Long-Term Monitoring Program, Operable Unit 1. Naval Air Station Pensacola. Pensacola, Florida. Prepared for Naval Facilities Engineering Command Southeast, Jacksonville, Florida. July.

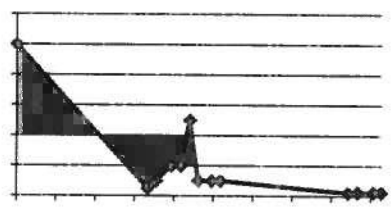
USDA (United States Department of Agriculture), 2004. *Soil Survey of Escambia County, Florida*.

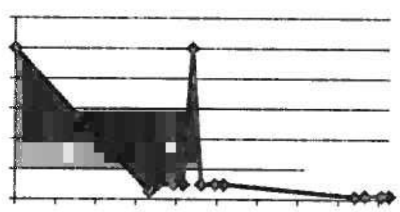
USEPA, 2001. “Comprehensive Five-Year Review Guidance”, Office of Emergency and Remedial Response, USEPA. June.

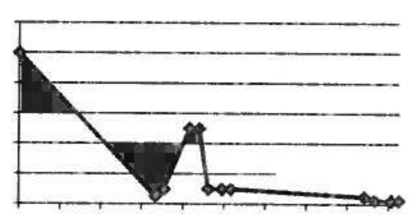
APPENDIX A

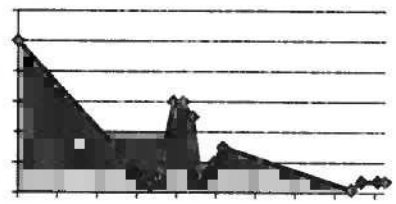
OU1 GROUNDWATER TREND ANALYSES

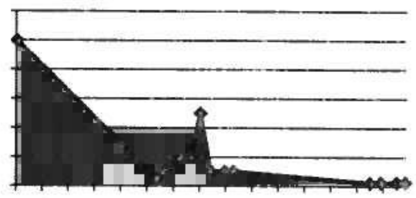


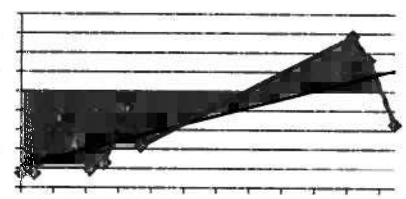


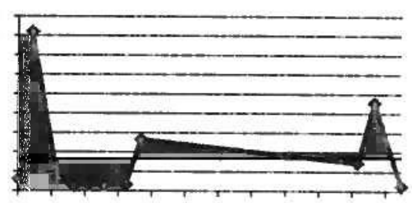


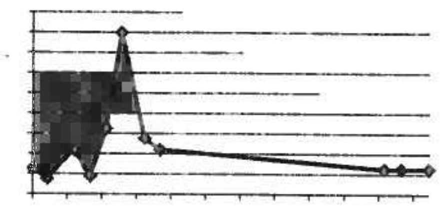


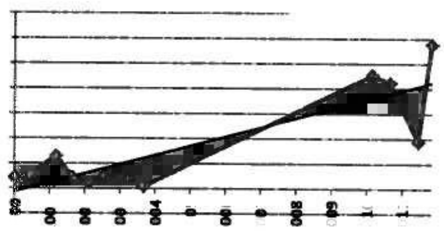


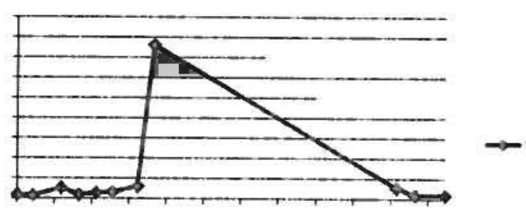


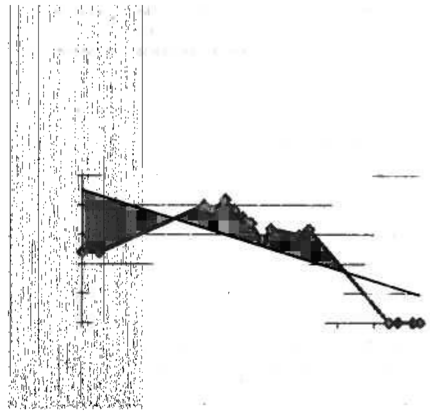


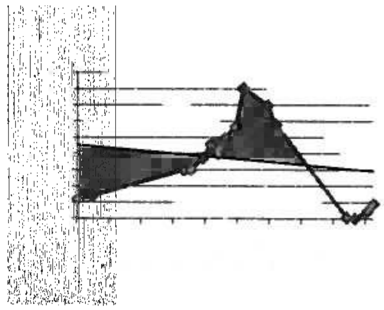


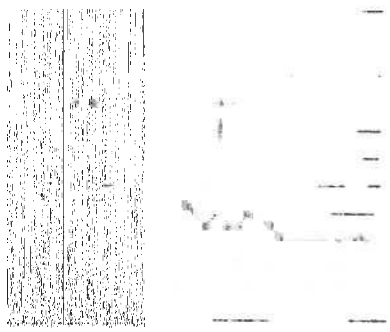


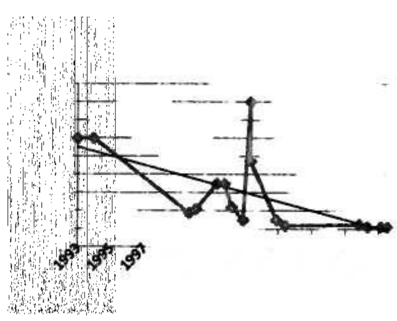


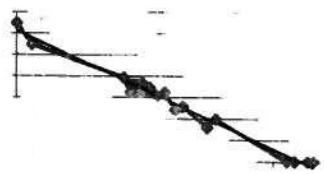


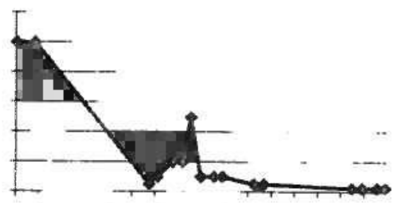


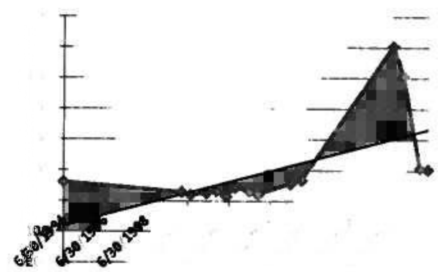


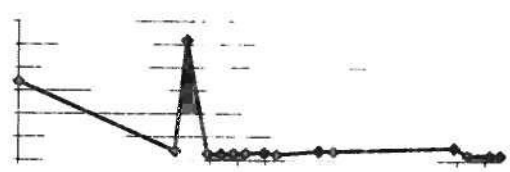


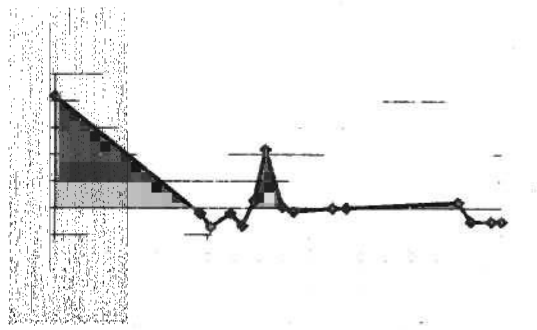

1993
1995
1997

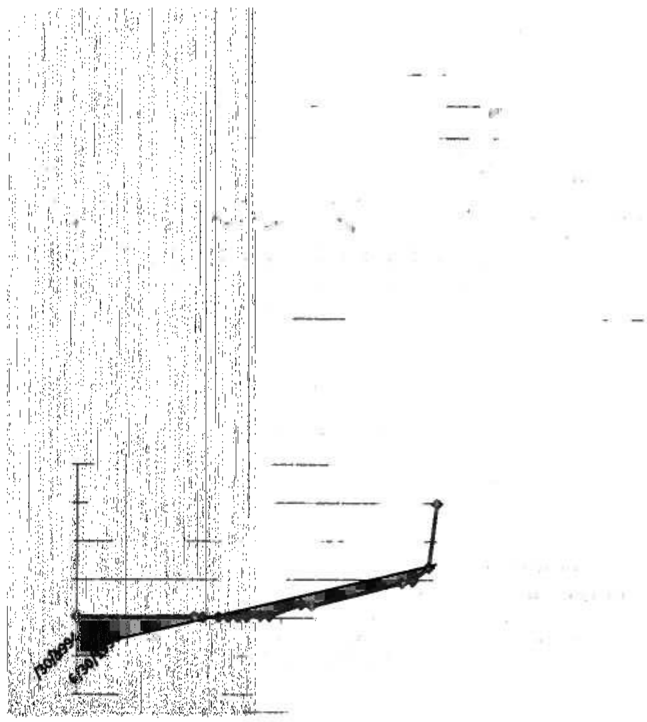


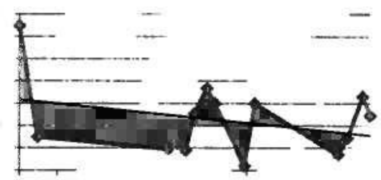


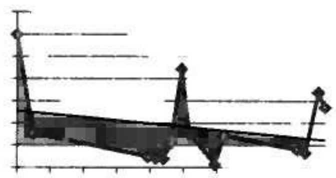


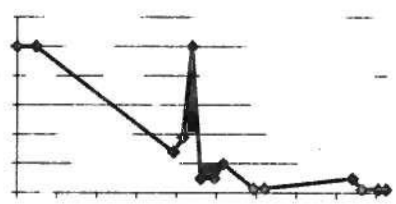


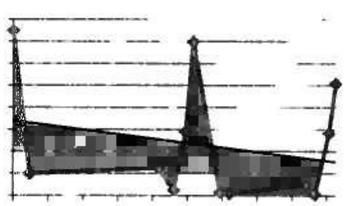


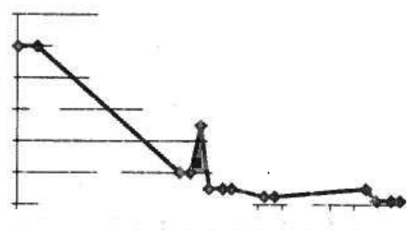


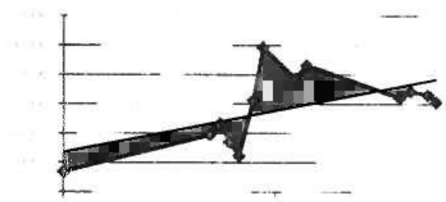


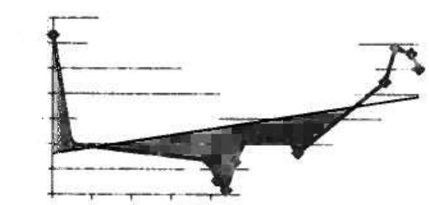


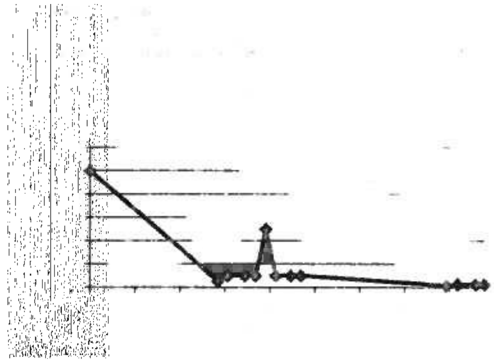


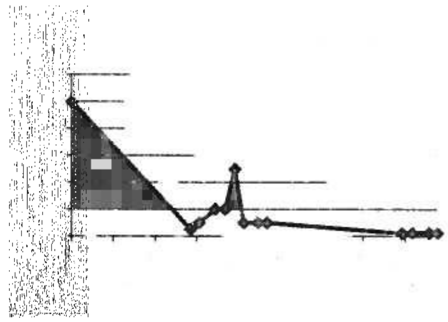


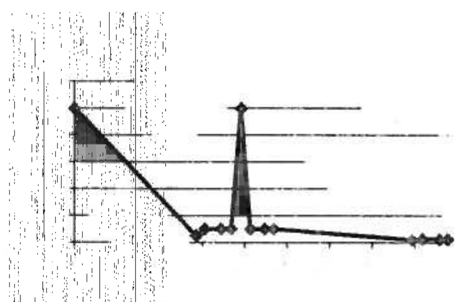


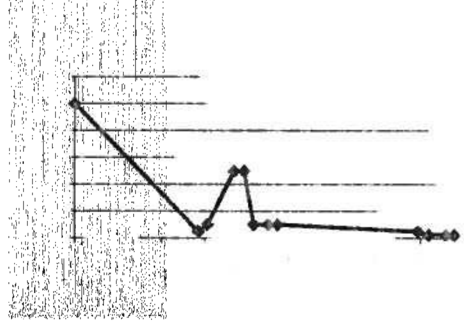


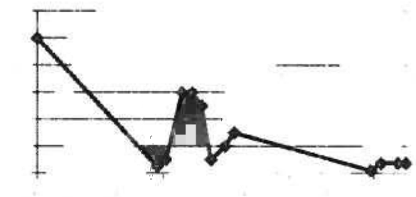


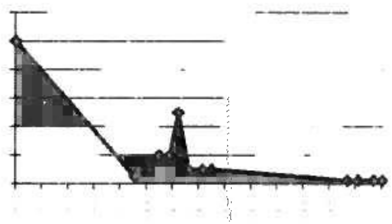


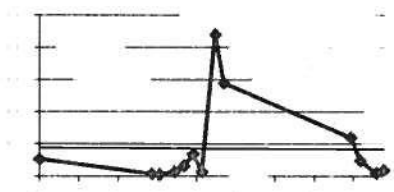


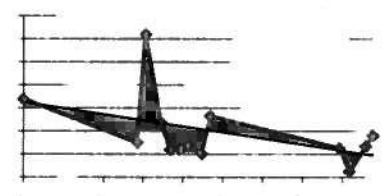


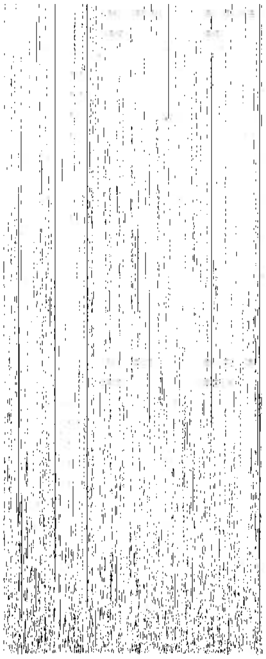


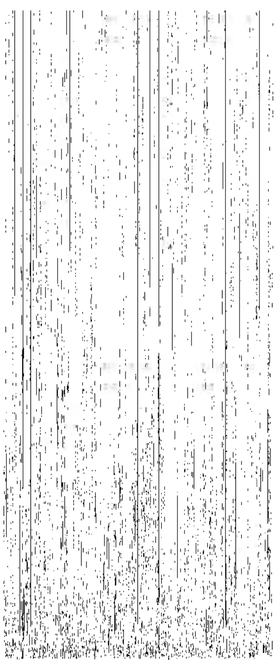


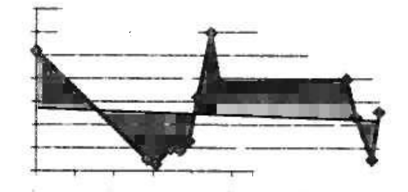


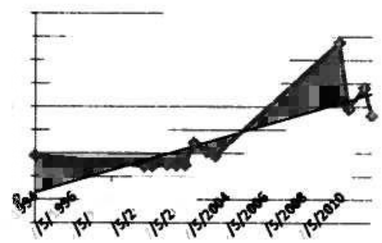


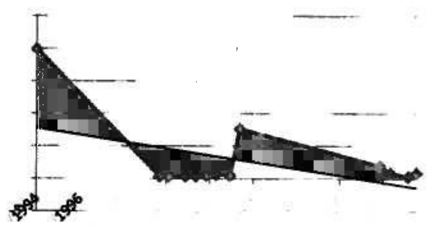


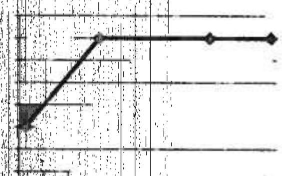


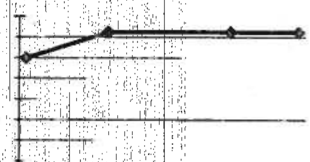


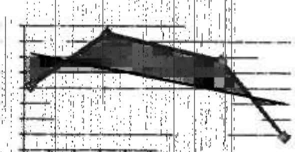


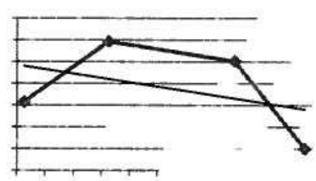

/5/2004
/5/2006
/5/2008
/5/2010

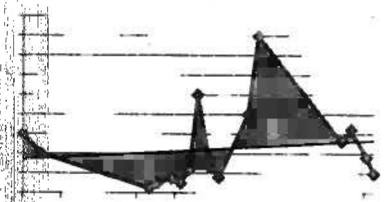

1996

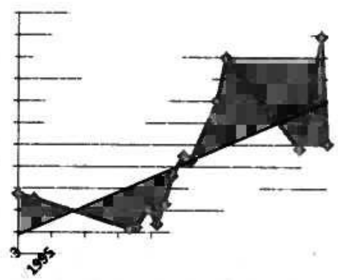


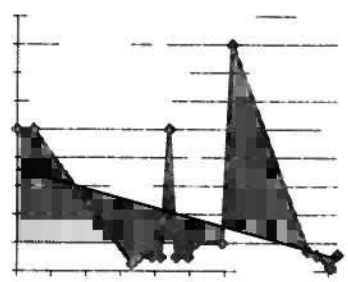


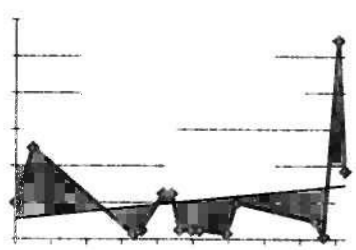


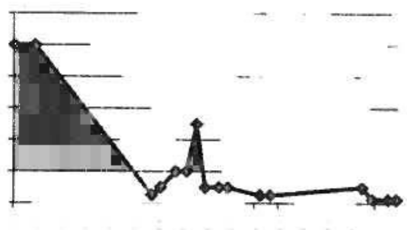


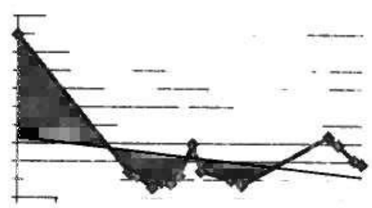


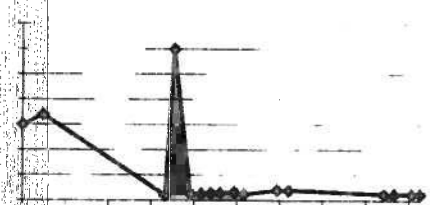


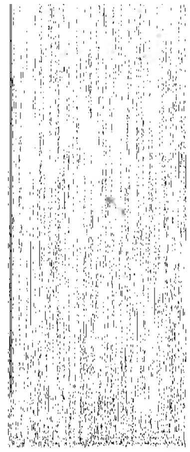


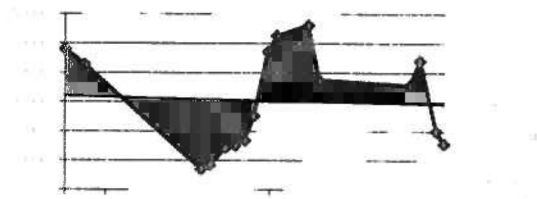




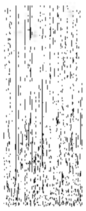


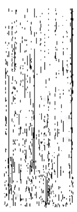


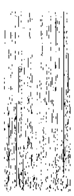


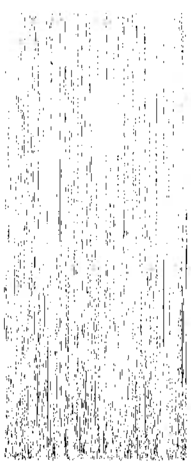


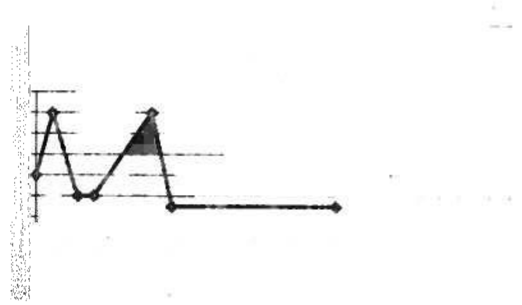


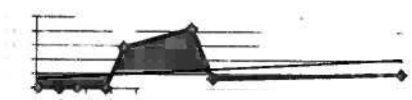


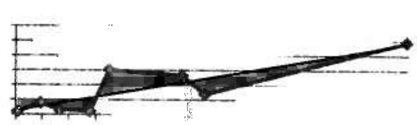


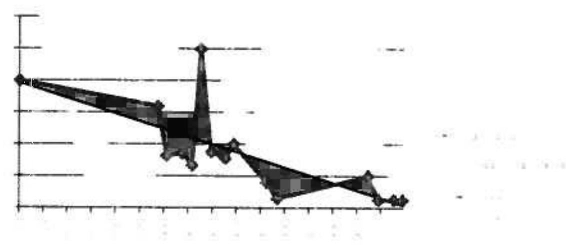


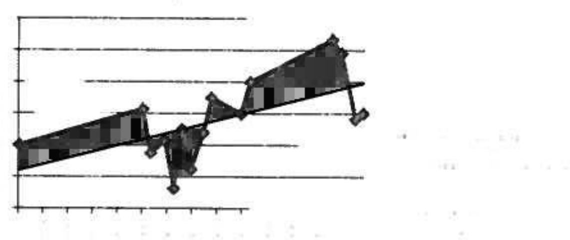


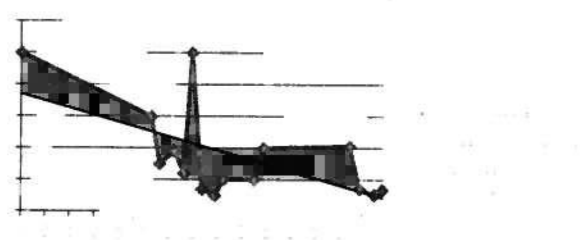


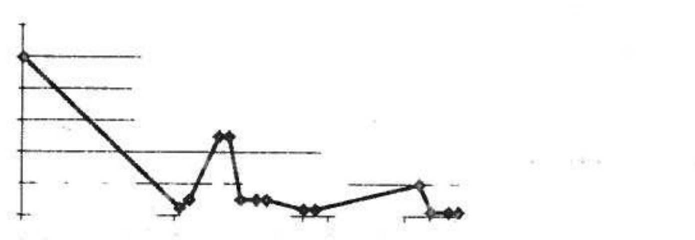


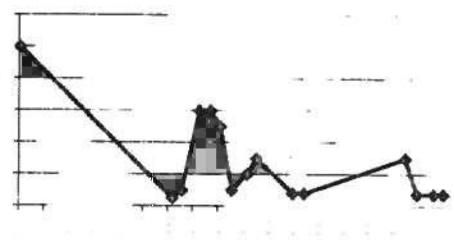


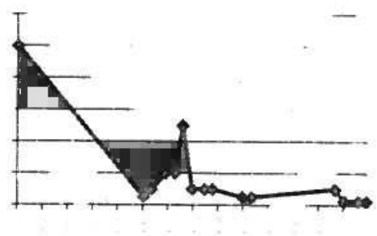


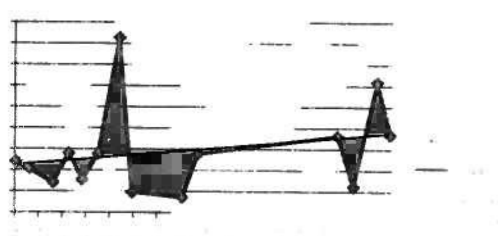


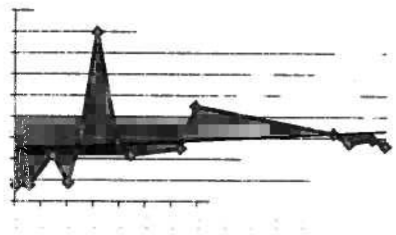


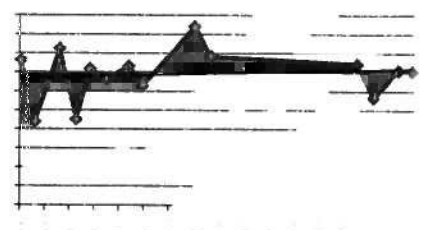


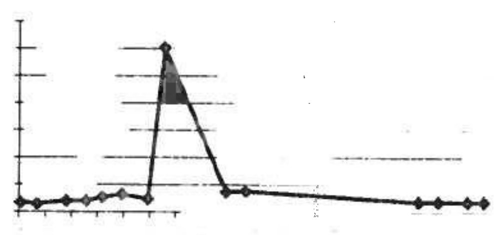


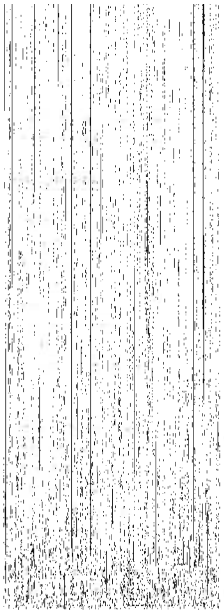


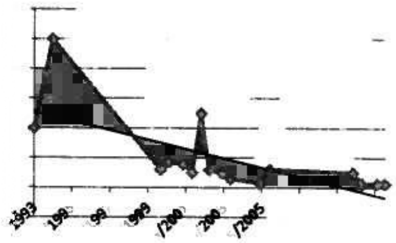


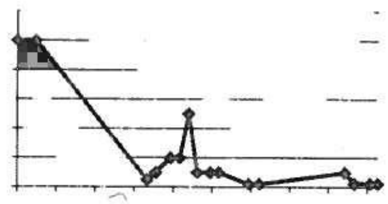


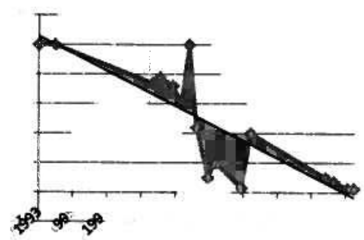


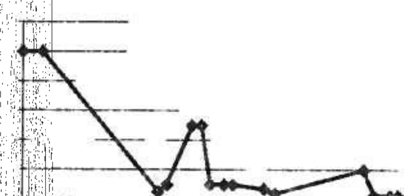


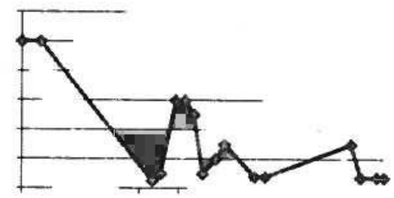


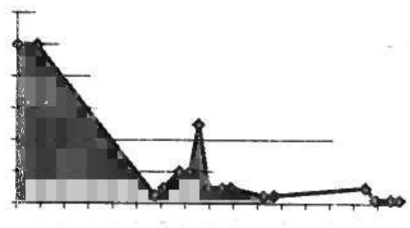

1993
/2005

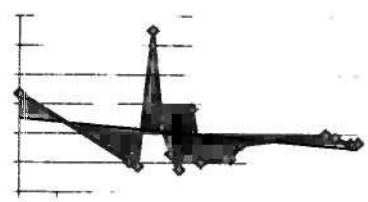


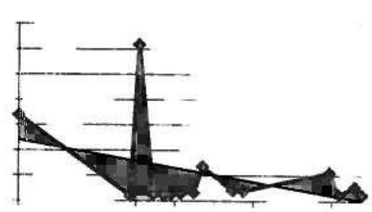

1993

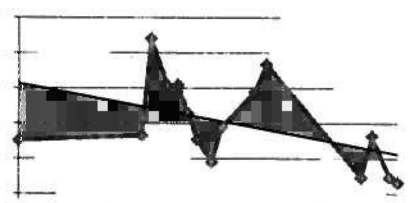


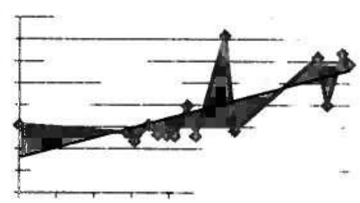


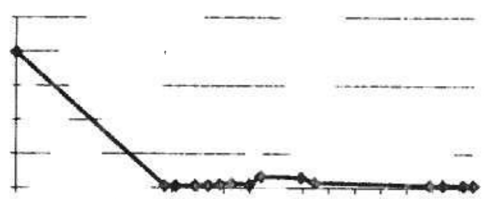


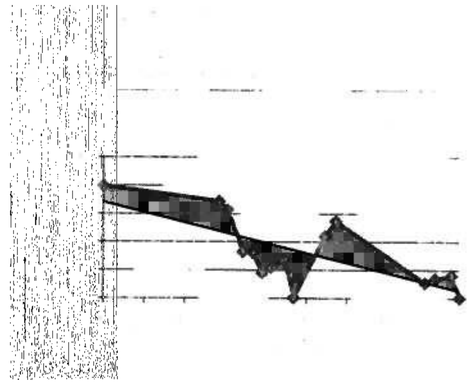


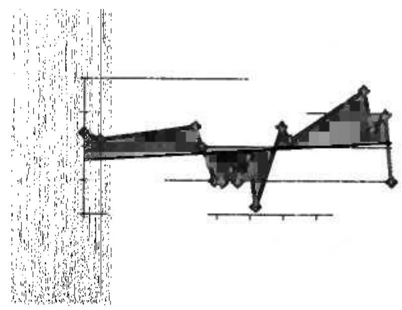


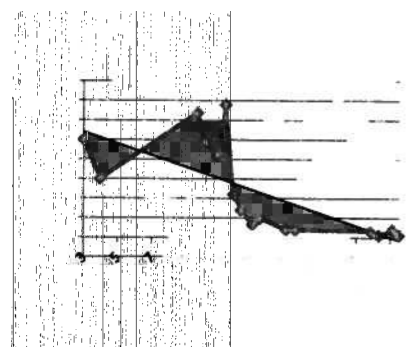


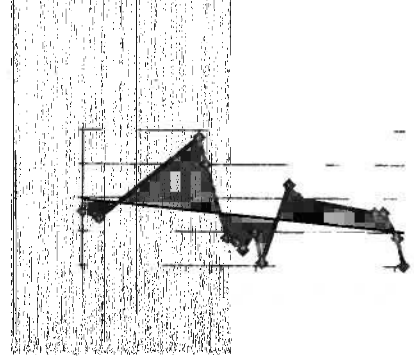


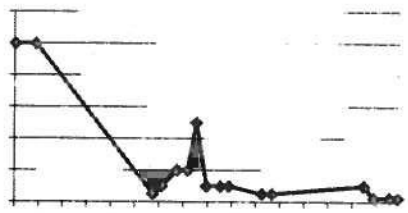


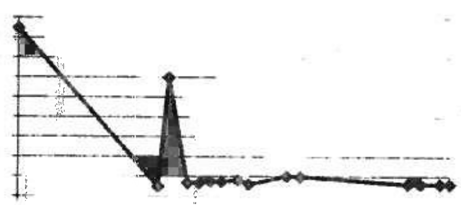


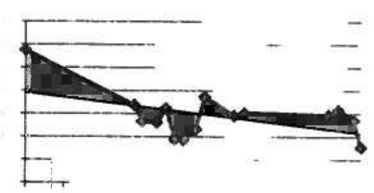


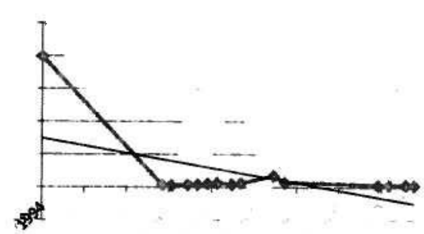


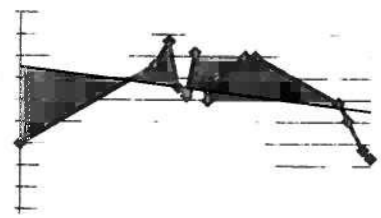


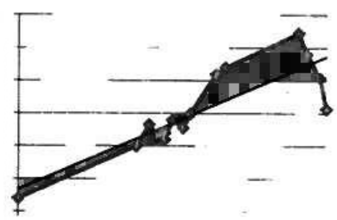


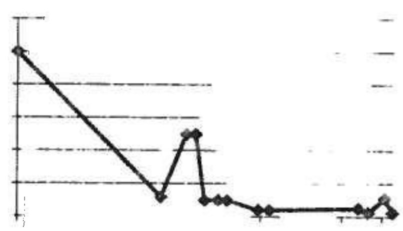


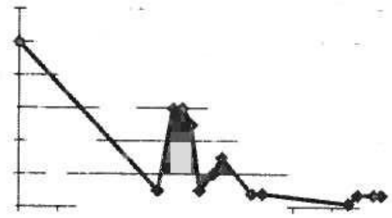


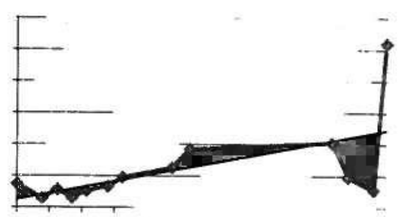


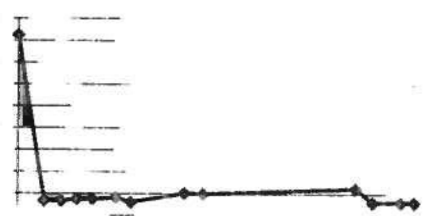


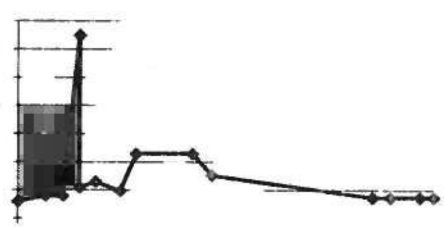


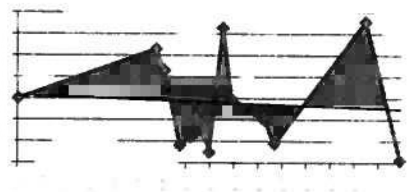


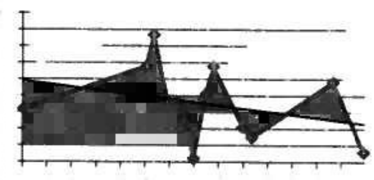


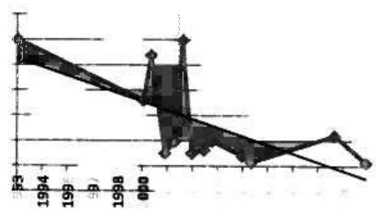


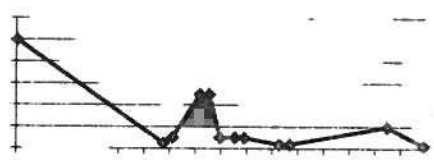


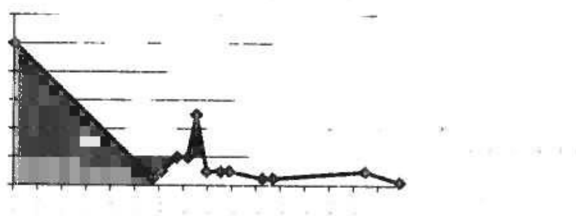


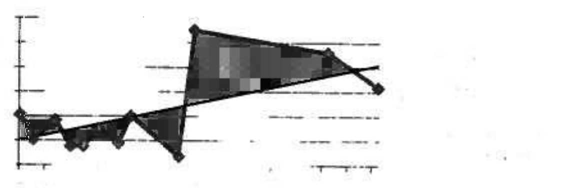


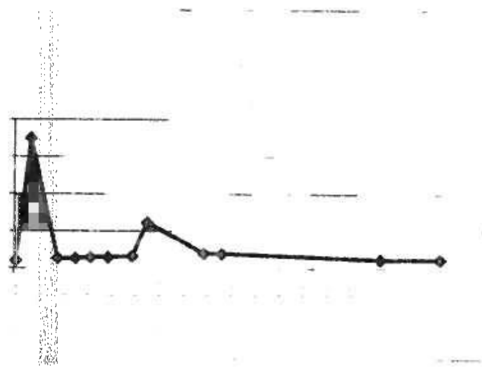


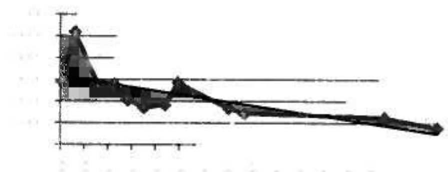

1994
1998

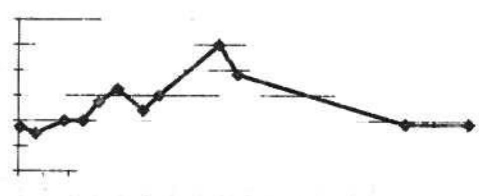




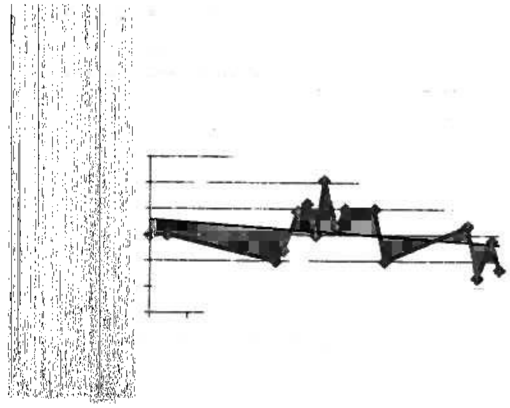


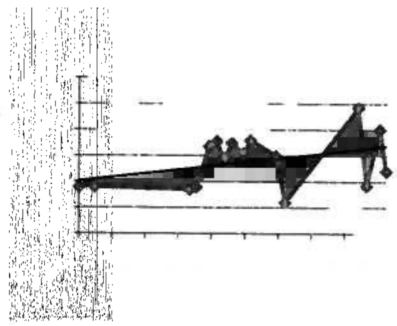


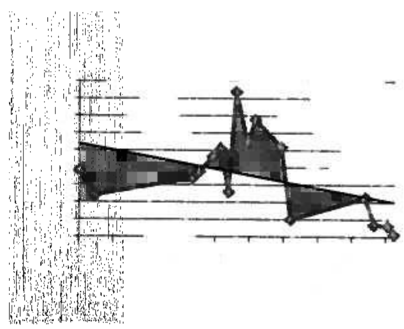


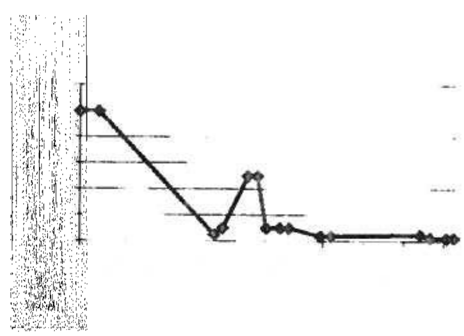


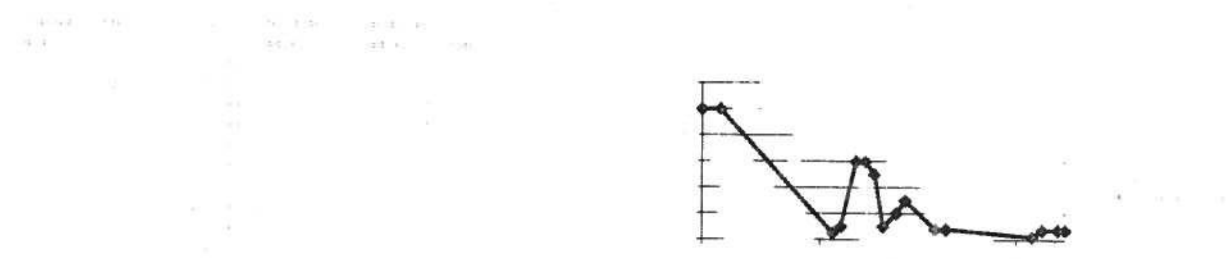
Manganese

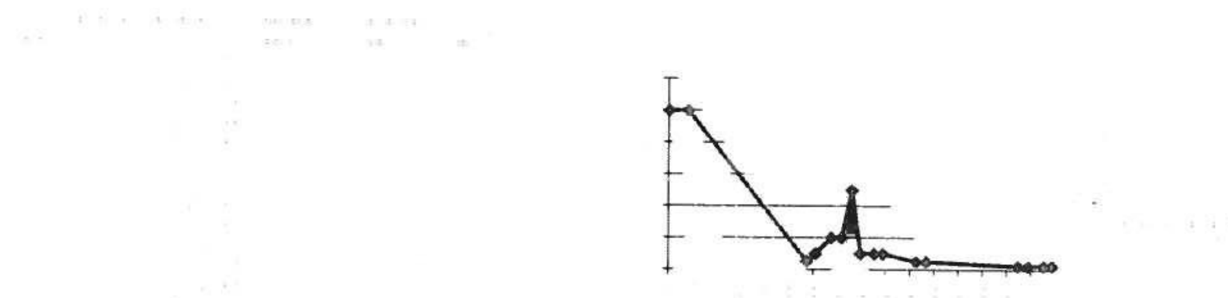


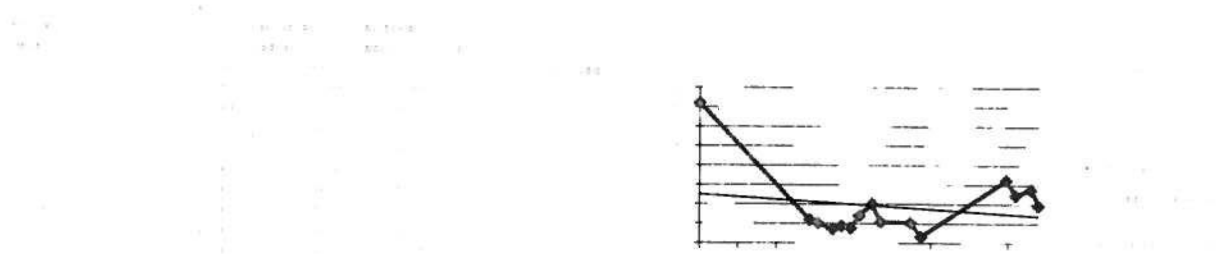


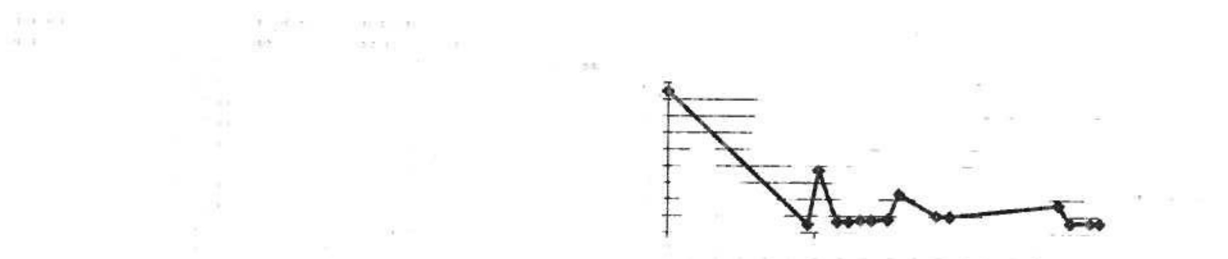


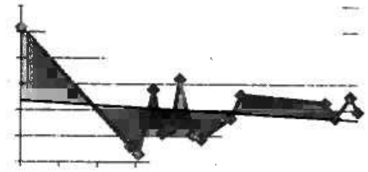


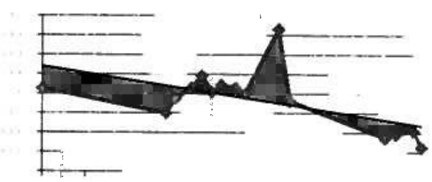


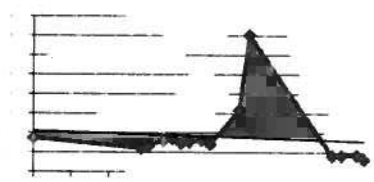


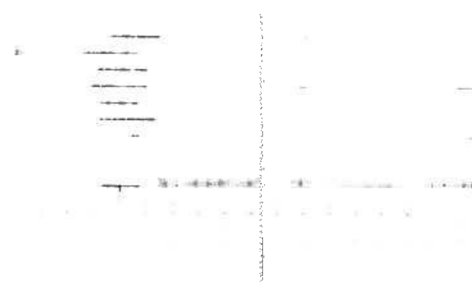


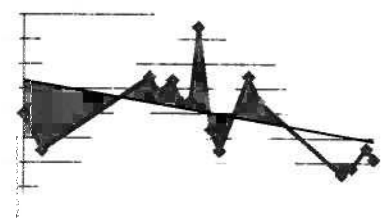


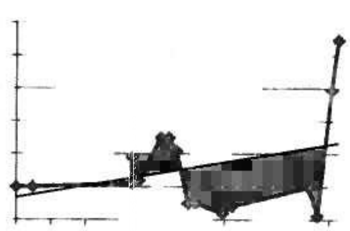


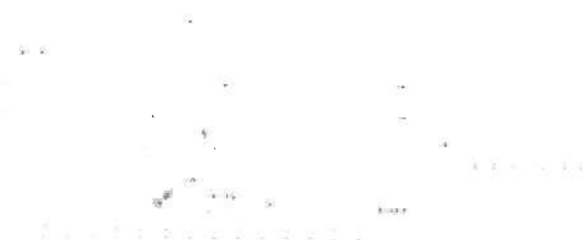


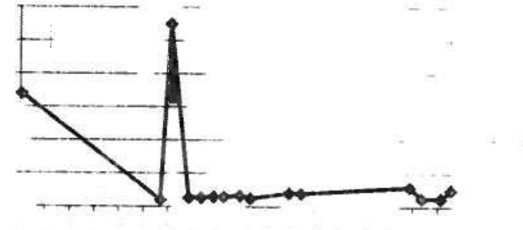


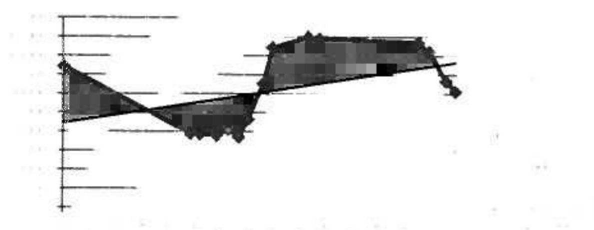


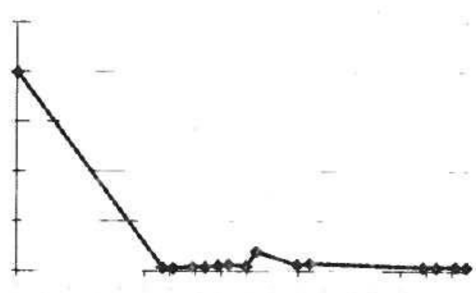


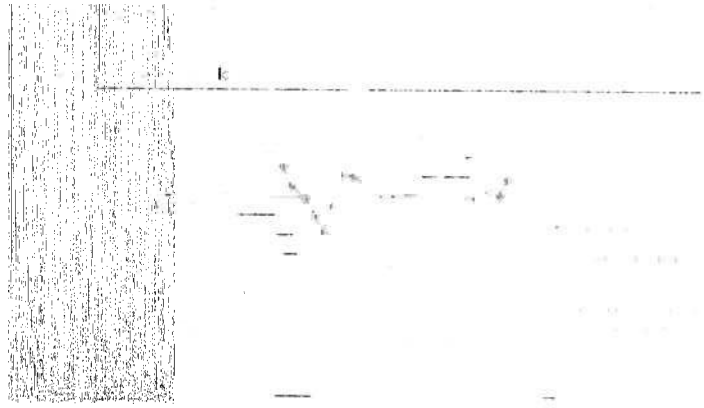


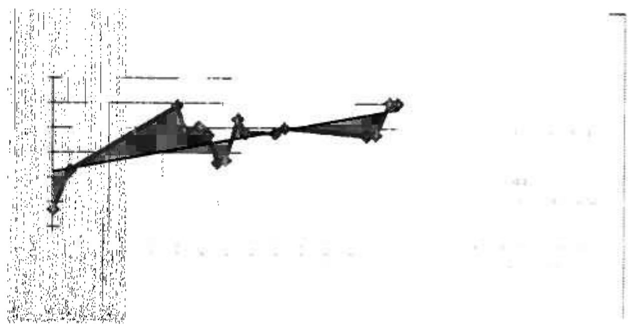


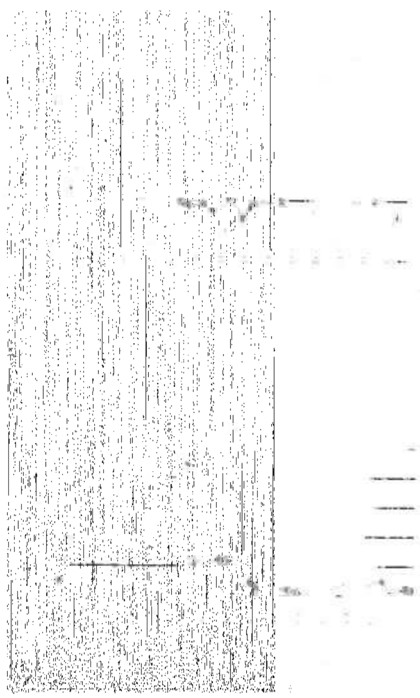


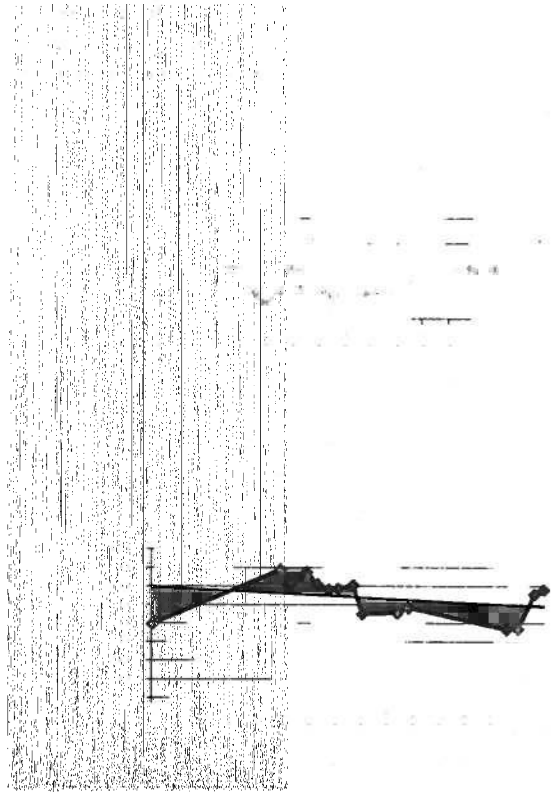


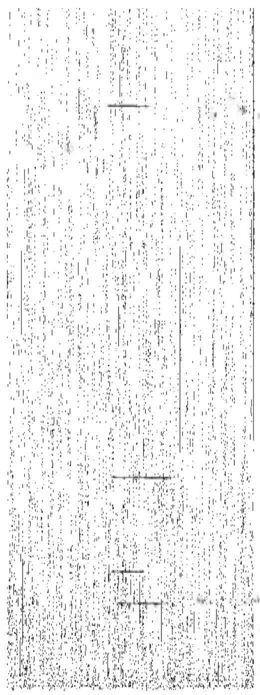


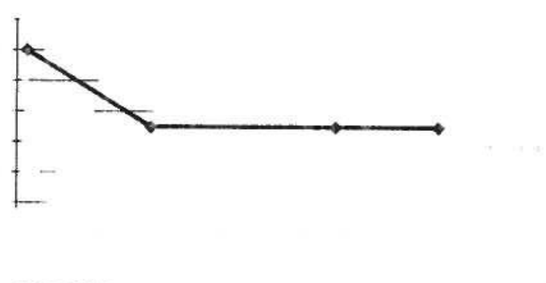


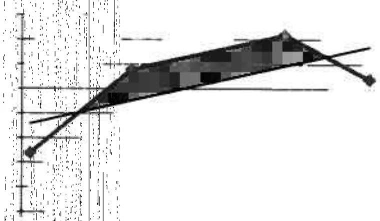


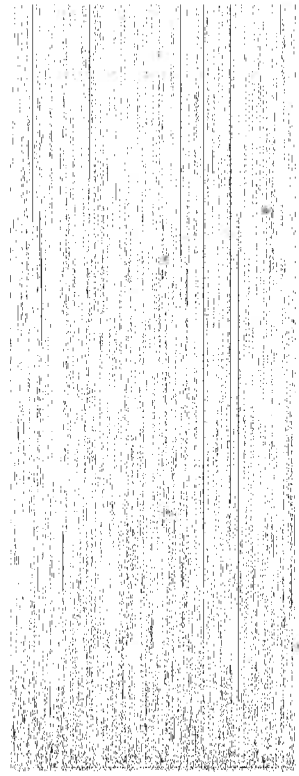


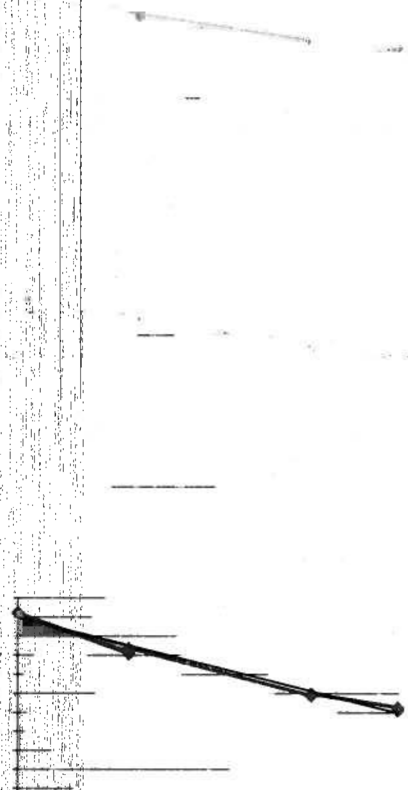


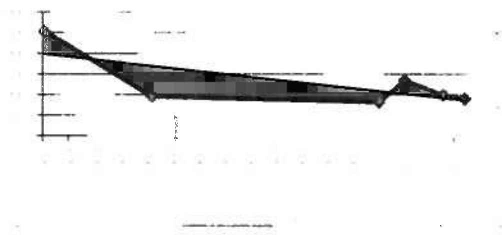


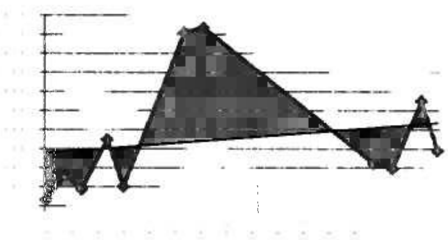


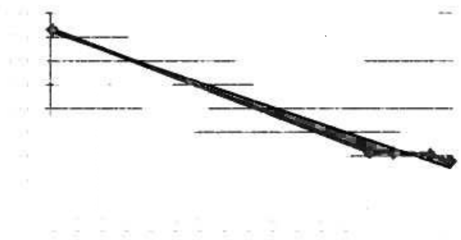


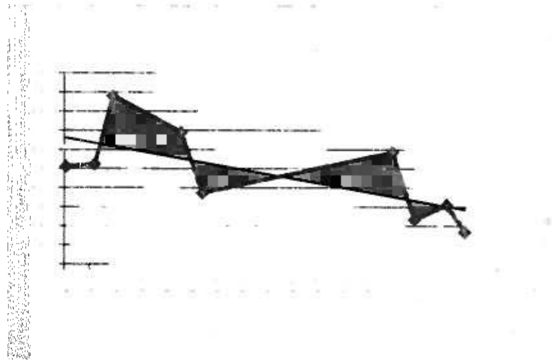


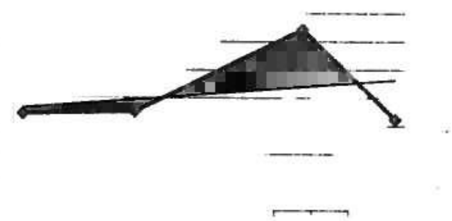












APPENDIX B

OU1 LUC INSPECTION CERTIFICATIONS, INTERVIEW FORMS, SITE INSPECTION FORM

INTERVIEW RECORD

Site Name: OU 1 Site 1 Former Sanitary Landfill	**EPA ID No.:**	
Subject:	**Time: 1325**	**Date: 5/2/12**
Type: Telephone Ξ Visit Other **Location of Visit: NAS Pensacola**	Incoming Outgoing	

Contact Made By:

Name: Peggy Churchill	**Title:** Project Manager	**Organization:** Tetra Tech Inc.
Name: Amber Igoe	**Title:** Environmental Specialist II	**Organization:** Tetra Tech Inc.

Individual Contacted:

Name: Greg Campbell	**Title:** Environmental Engineer	**Organization:** NAVFAC
Telephone No: (850) 452-3131 ext 3007 **Fax No:** **E-Mail Address:** gregory.campbell@navy.mil	**Street Address:** 310 John Tower Road **City, State, Zip:** Pensacola FL, 32508	

Summary Of Conversation

The overall impression of the project is that it is great the Land Use Controls (LUCs) are in place to prevent exposure or any building in the area. Site operations have not affected the surrounding community and there has not been any reported community concerns. Local authorities have not received reports of vandalism, trespassing or any emergency responses occurring at the Site. The base is well informed of Site activity, progress and LUC inspections are conducted annually. Mr. Campbell commented that is was a good idea to shut down the iron recovery system and begin using the wetland system for passive treatment as agreed upon by the Partnering Team.

VIE D

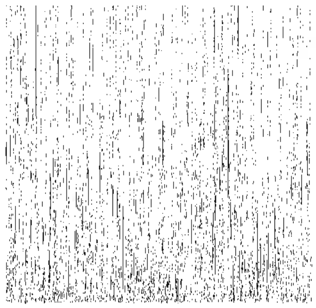
6 [illegible] [illegible] [illegible] PWD NA [illegible] 2

F R

R w

p M

6.



7.

8.

VIE D

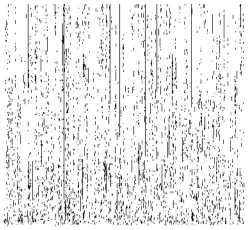
NA

6 [illegible] [illegible] [illegible] PWD [illegible] 2

INTERVIEW RECORD

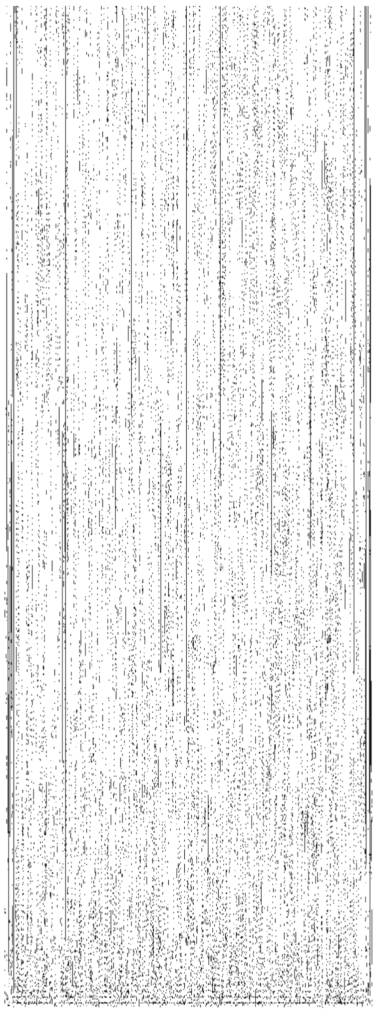
Name	Title	Organization
Name	Title	Organization

Summary Of Conversation



[illegible]

M



TETRA TECH

APPENDIX C

OU2 LUC INSPECTION CERTIFICATIONS, INTERVIEW FORMS, SITE INSPECTION FORM

INTERVIEW RECORD

Site Name: OU 2 Sites 11, 12, 25, 26, 27 and 30		**EPA ID No.:**	
Subject:		**Time: 1345**	**Date: 5/2/12**
Type: Telephone Ξ Visit Other **Location of Visit: NAS Pensacola**		Incoming Outgoing	

Contact Made By:

Name: Peggy Churchill	**Title:** Project Manager	**Organization:** Tetra Tech Inc.
Name: Amber Igoe	**Title:** Environmental Specialist II	**Organization:** Tetra Tech Inc.

Individual Contacted:

Name: Greg Campbell	**Title:** Environmental Engineer	**Organization:** NAVFAC
Telephone No: (850) 452-3131 ext 3007 **Fax No:** **E-Mail Address:** gregory.campbell@navy.mil	**Street Address:** 310 John Tower Road **City, State, Zip:** Pensacola FL, 32508	

Summary Of Conversation

The overall impression of the project is that it is going well. The coordination between the Navy and RASO at Site 27 and the Navy and DRMO at Site 12 has been very successful. Site operations have not affected the surrounding community and there has not been any reported community concerns. Local authorities have not received reports of vandalism, trespassing or any emergency responses occurring at the Site. The base is well informed of Site activity, progress and Land Use control (LUC) inspections are conducted annually.

I

6 [illegible]

F p

C

6.

7.

8.

I

6 [illegible] PWD [illegible]

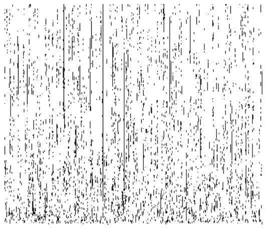
INTERVIEW RECORD

Summary Of Communication

n

n

k



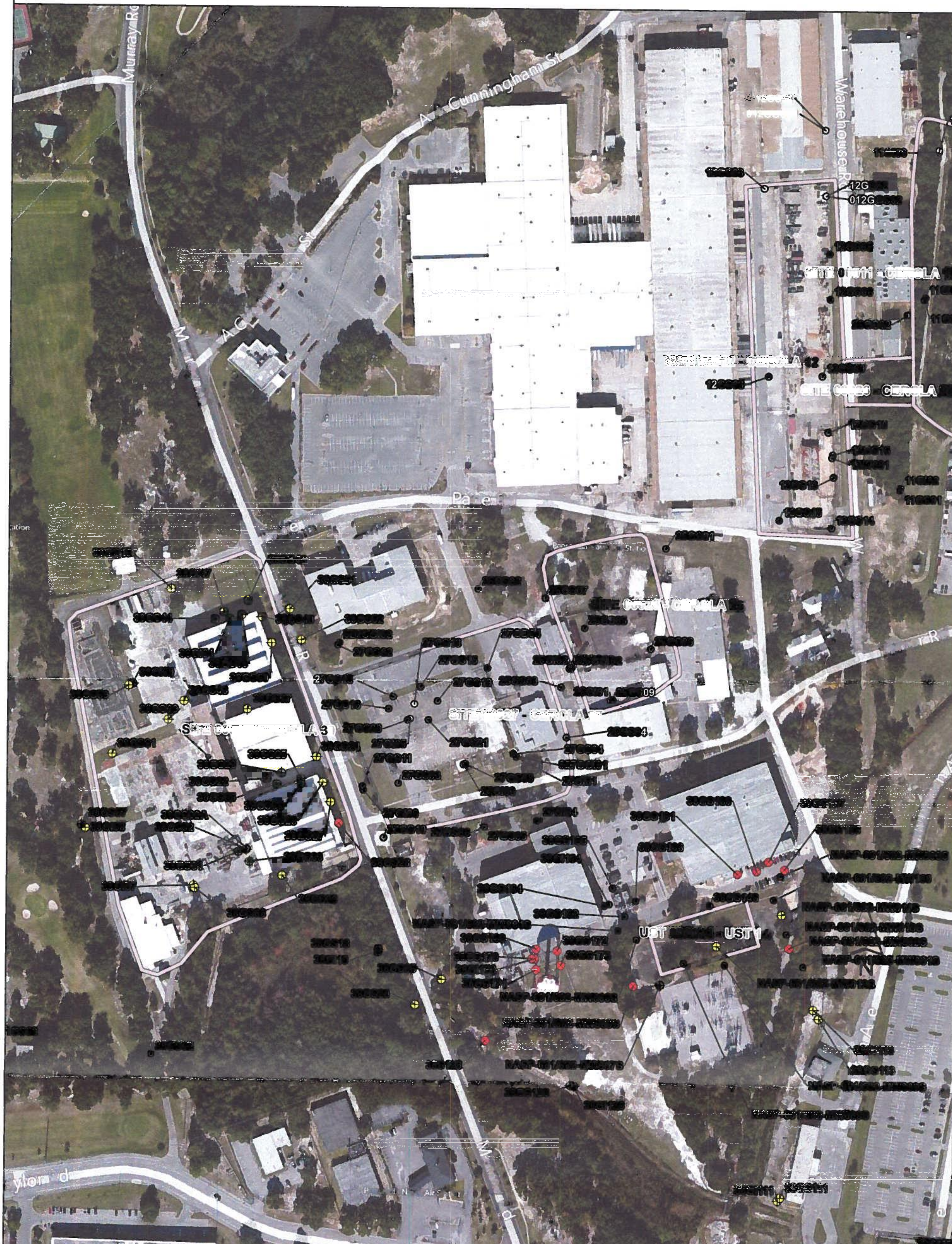
Y n

ME

M

F

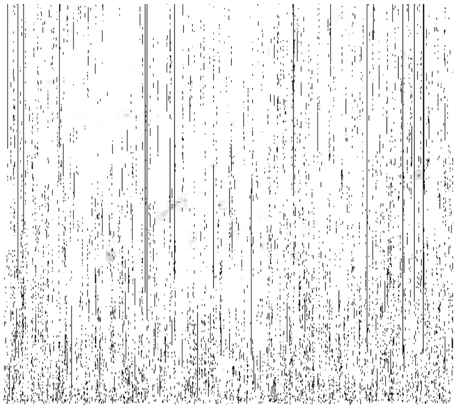
G



TETRA TECH

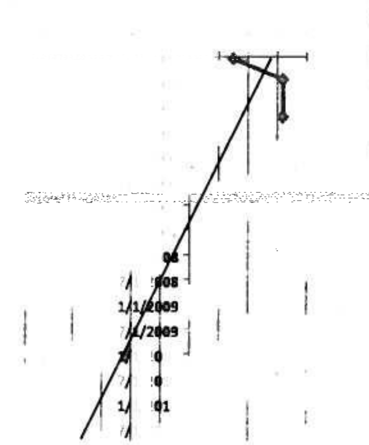
A A Cunningham St
Warehouse Rd
012GGS01
11GI06
SITE 00011 - CERCLA 11
SITE 00028 - CERCLA 28
SITE 00027 - CERCLA 27
UST 1

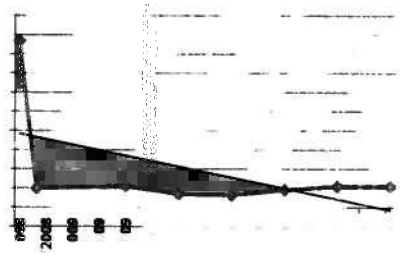
TETRA TECH

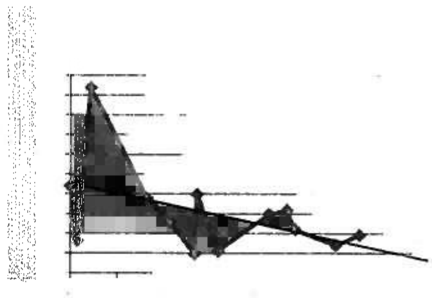


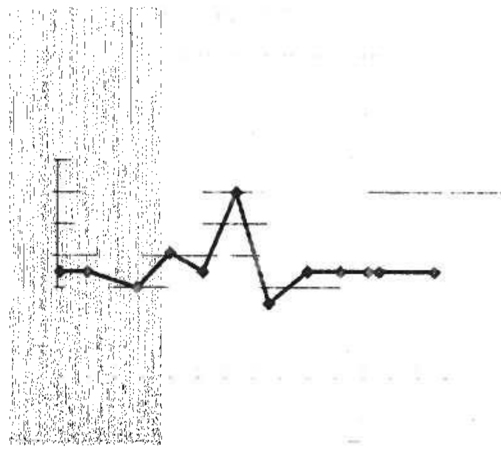
APPENDIX D

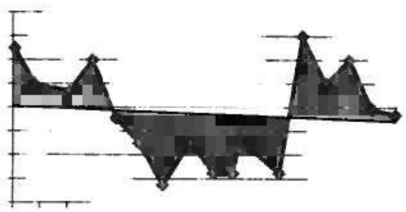
OU4 GROUNDWATER TREND ANALYSES

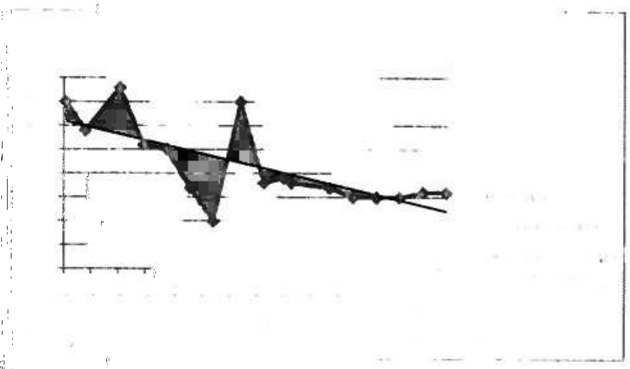

1/1/2009
7/1/2009

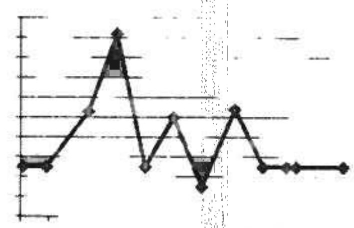


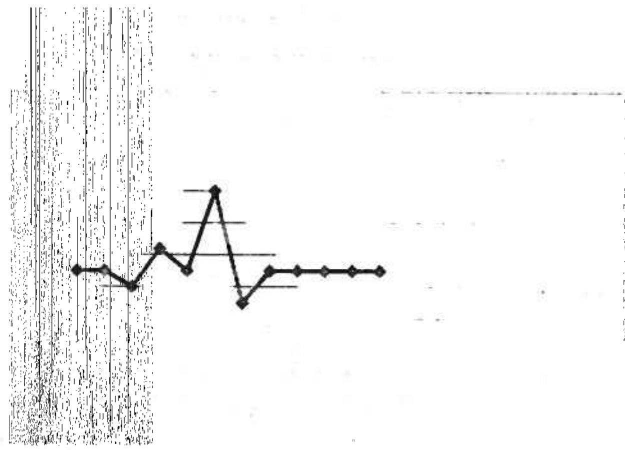


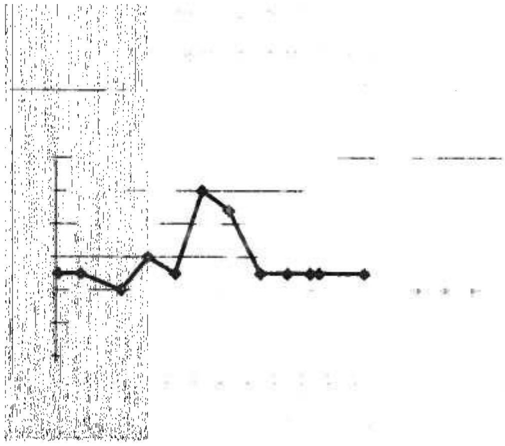


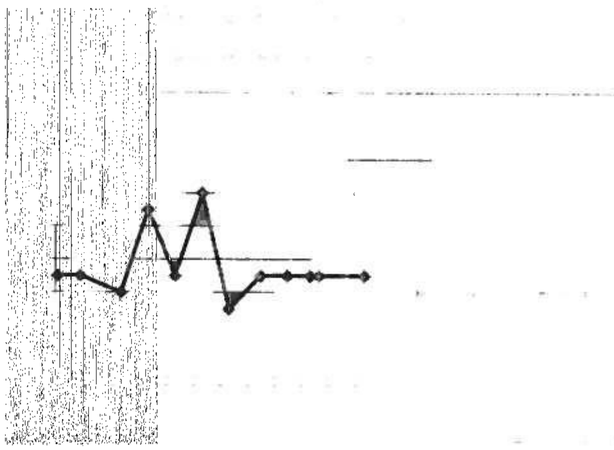


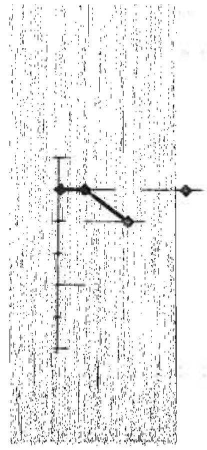












APPENDIX E

OU4 LUC INSPECTION CERTIFICATIONS, INTERVIEW FORMS, SITE INSPECTION FORM

INTERVIEW RECORD

Site Name: OU 4 Site 15 Pesticide Rinseate Disposal Area	**EPA ID No.:**	
Subject:	**Time: 1405**	**Date: 5/2/12**
Type: Telephone Ξ Visit Other **Location of Visit: NAS Pensacola**	Incoming Outgoing	

Contact Made By:

Name: Peggy Churchill	**Title:** Project Manager	**Organization:** Tetra Tech Inc.
Name: Amber Igoe	**Title:** Environmental Specialist II	**Organization:** Tetra Tech Inc.

Individual Contacted:

Name: Greg Campbell	**Title:** Environmental Engineer	**Organization:** NAVFAC

Telephone No: (850) 452-3131 ext 3007 **Fax No:** **E-Mail Address:** gregory.campbell@navy.mil	**Street Address:** 310 John Tower Road **City, State, Zip:** Pensacola FL, 32508

Summary Of Conversation

The overall impression of the project is that the contamination is in a very localized area and is contained. Site operations have not affected the surrounding community and there has not been any reported community concerns. Local authorities have not received reports of vandalism, trespassing or any emergency responses occurring at the Site. The base is well informed of Site activity and progress. The Land Use Control Inspections are conducted annually. A maintenance warehouse is being proposed to be constructed in the area; the proper individuals have been informed of the contamination and all proper measures will be implemented to protect worker safety.

D N

EG A N A EN

I R

rf M

6.

7.

8.

INTERVIEW RECORD

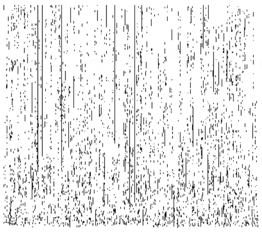
Contact Made By

Name	Title	Organization

Individual Contacted

Name	Title	Organization

Summary Of Conversation

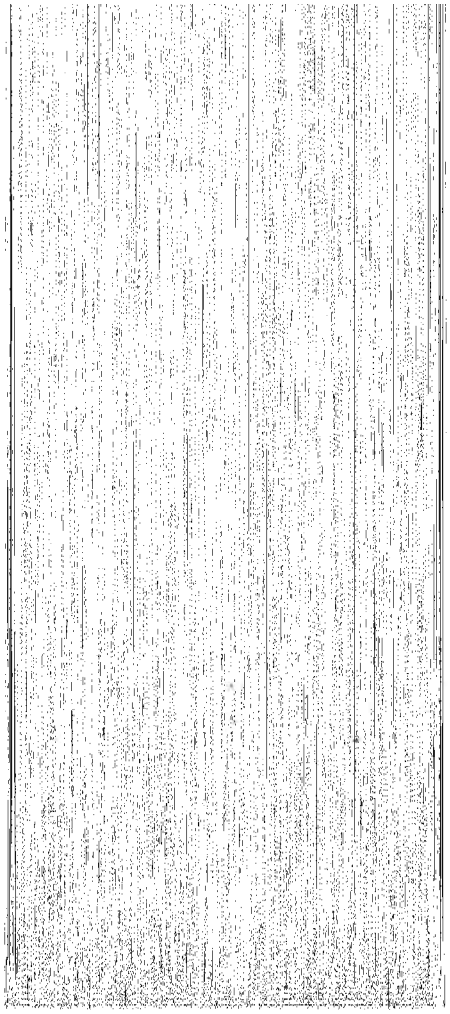


T

[redacted]

4.

[redacted]



NAS PENSACOLA - 5 YEAR REVIEW MONITOR WELL INVENTORY

FIGURE

AREA

5 YEAR REVIEW

NAS PENSACOLA

NAVAL AIR STATION PENSACOLA

NAS PENSACOLA PENSACOLA, FLORIDA

sor n th

Gre C l

APPENDIX F

OU11 LUC INSPECTION CERTIFICATIONS, INTERVIEW FORMS, SITE INSPECTION FORM

INTERVIEW RECORD

Site Name: OU 11 Site 38 Hazardous Waste Storage Facility	**EPA ID No.:**	
Subject:	**Time: 1445**	**Date: 5/2/12**
Type: Telephone Ξ Visit Other **Location of Visit: NAS Pensacola**	Incoming Outgoing	

Contact Made By:

Name: Peggy Churchill	**Title:** Project Manager	**Organization:** Tetra Tech Inc.
Name: Amber Igoe	**Title:** Environmental Specialist II	**Organization:** Tetra Tech Inc.

Individual Contacted:

Name: Greg Campbell	**Title:** Environmental Engineer	**Organization:** NAVFAC

Telephone No: (850) 452-3131 ext 3007 **Fax No:** **E-Mail Address:** gregory.campbell@navy.mil	**Street Address:** 310 John Tower Road **City, State, Zip:** Pensacola FL, 32508

Summary Of Conversation

The overall impression of the project is that the soil removal went well. The beautification project following the soil removal has provided a nice gazebo area for the community. Local authorities have not received reports of vandalism, trespassing or any emergency responses occurring at the Site. The base is well informed of Site activity, progress and Land Use Control (LUC) inspections are conducted annually.

D ORM

CAMPBELL NVA PENSACOLA

F rv

R I

A

6.

7.

8.

D ORM

CAMPBELL NV A PENSACOLA

INTERVIEW RECORD

Event Name		[illegible]
Subject		Date / Time
Type: [illegible]		[illegible]

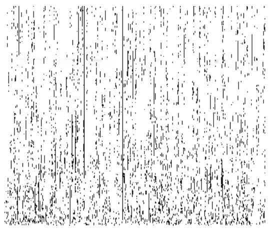
[illegible]

Name	Title	Organization

Individual Interviewed

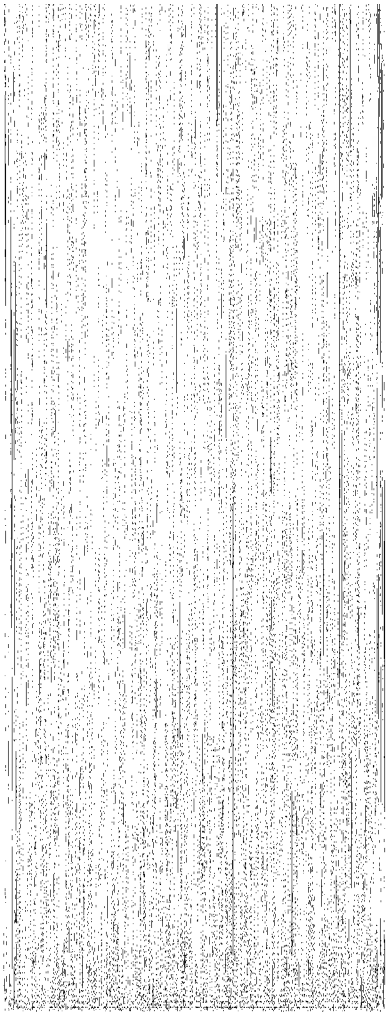
Name	Title	Organization
Telephone No. / Fax No. / E-mail address	Street Address / City, State, Zip	

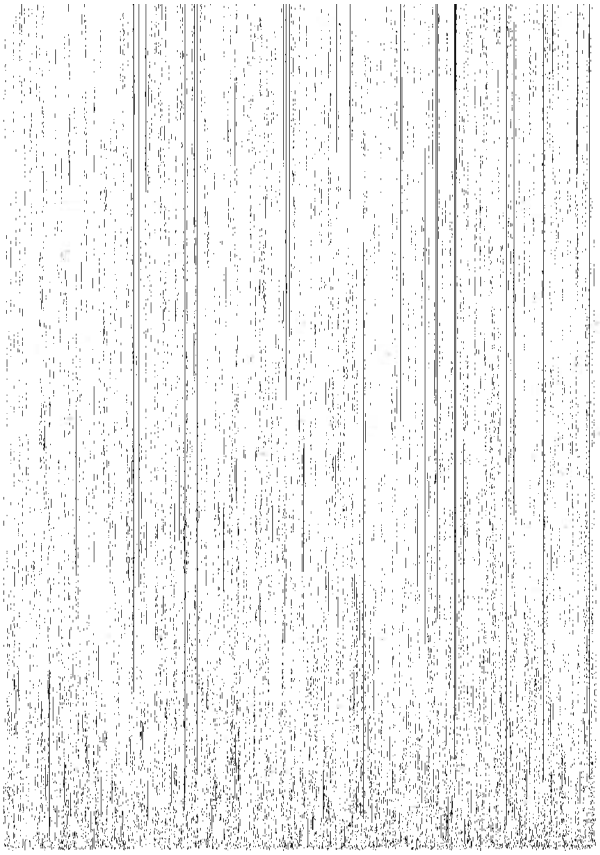
Summary of Conversation

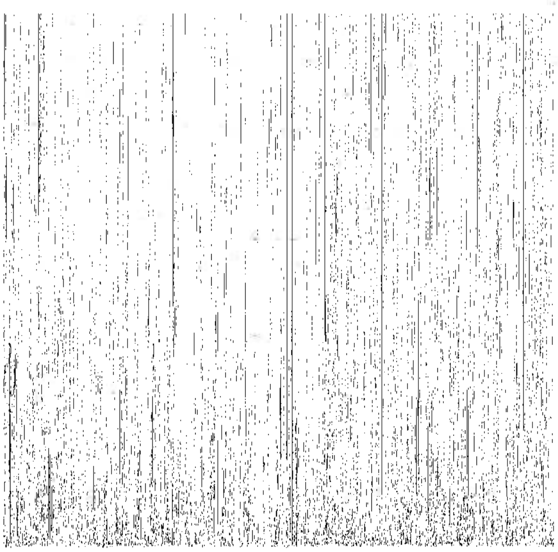


R

R

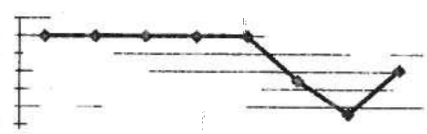


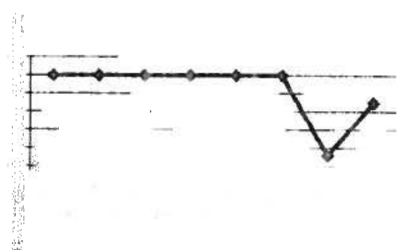


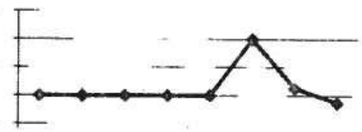


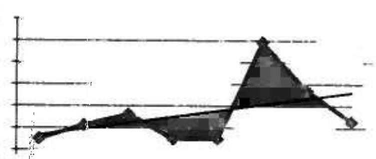
APPENDIX G

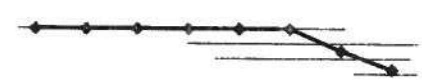
OU13 GROUNDWATER TREND ANALYSES

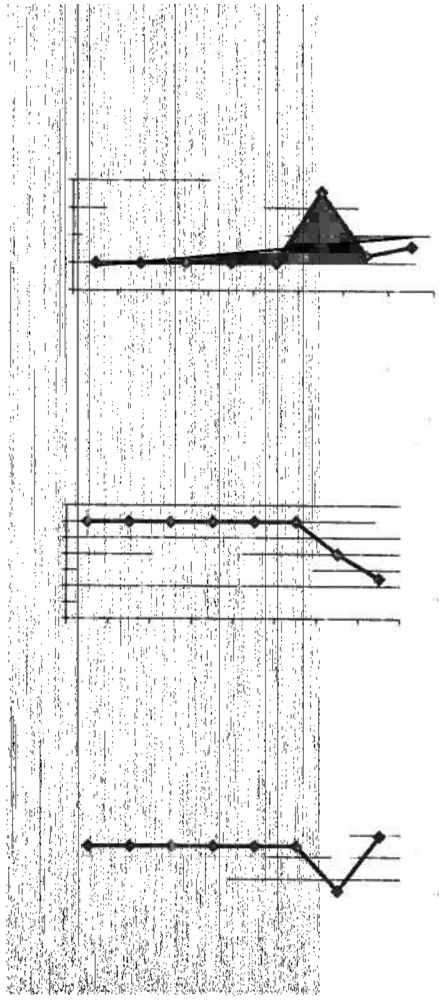


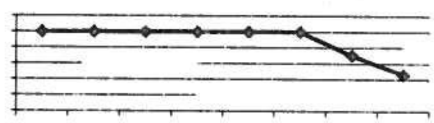


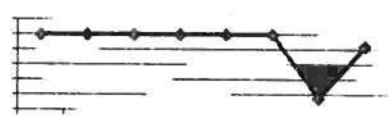


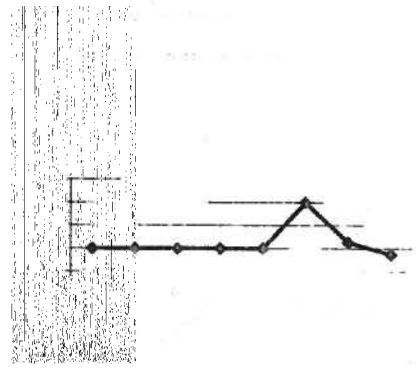


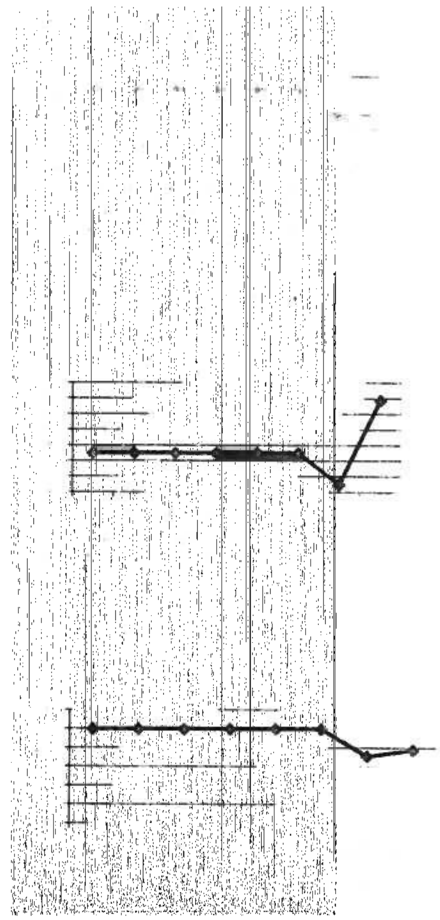


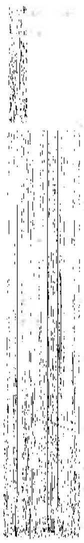


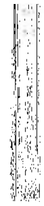


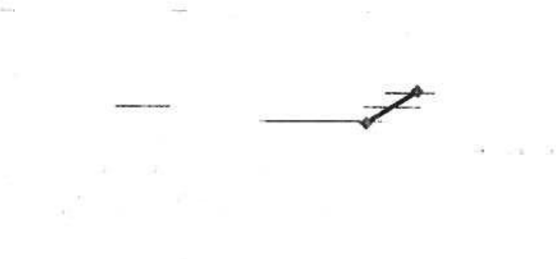


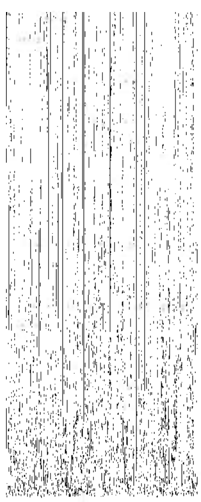


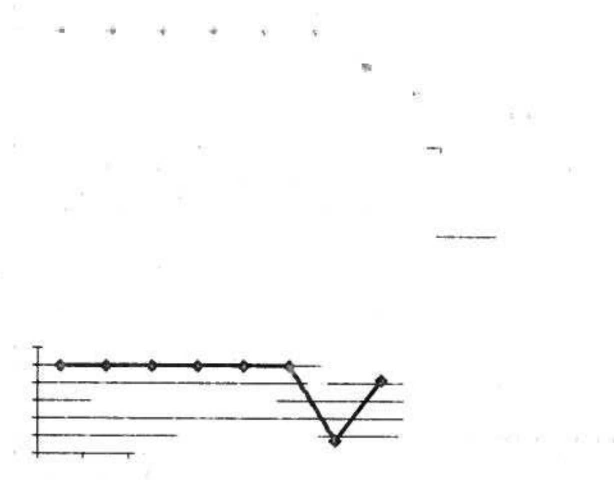


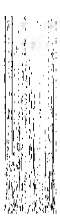


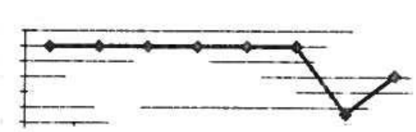


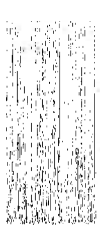


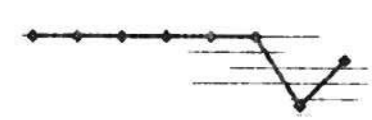


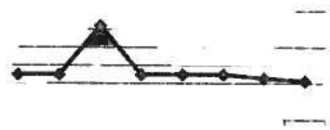


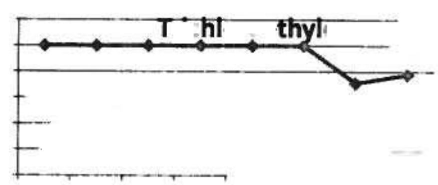


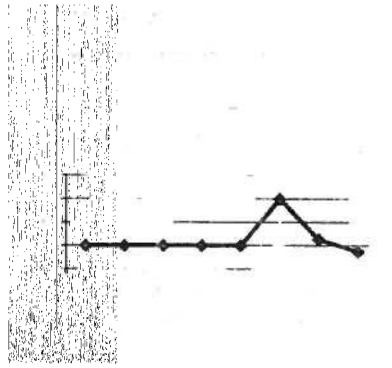


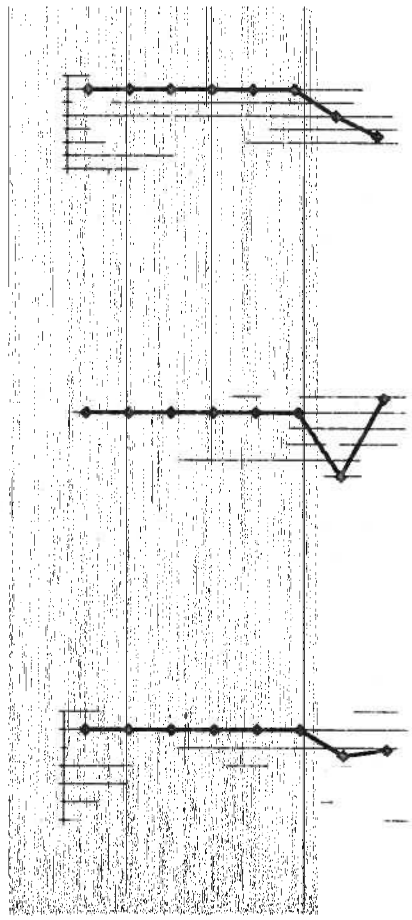


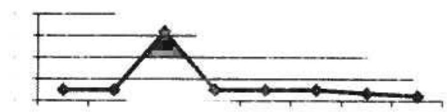


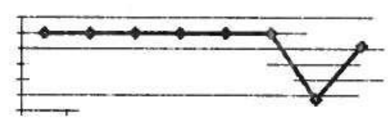


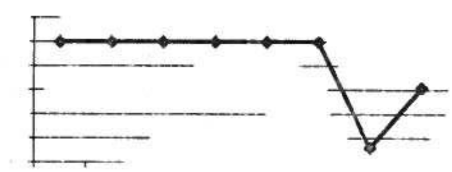


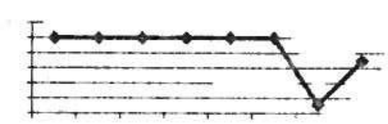


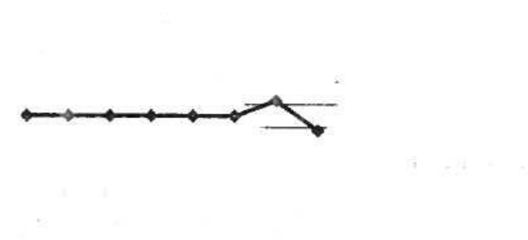


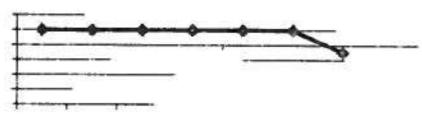


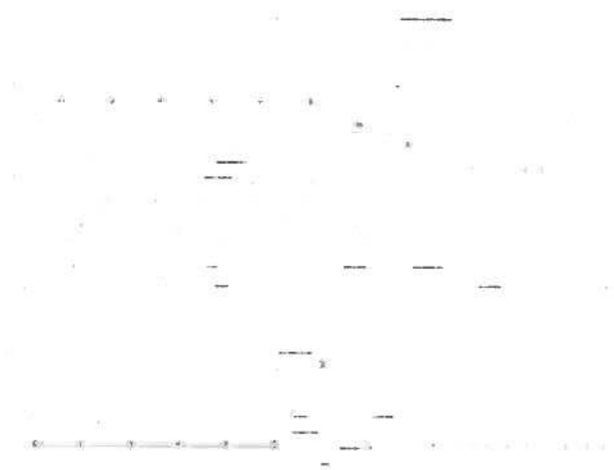


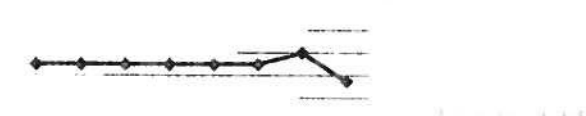


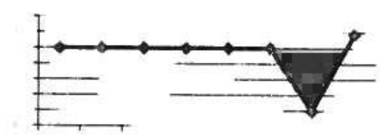


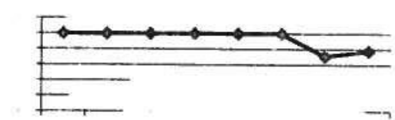


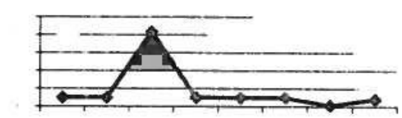


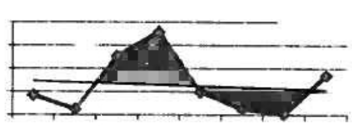


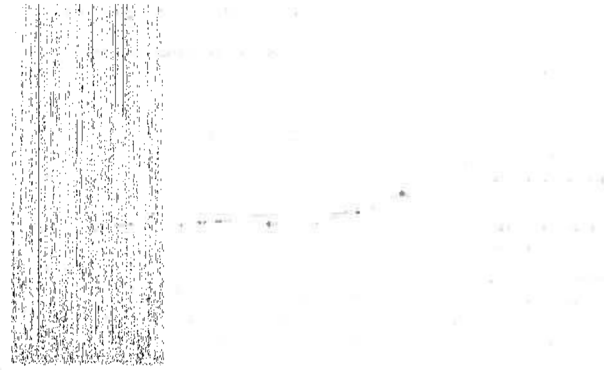


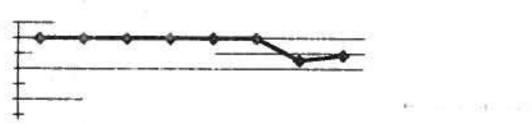


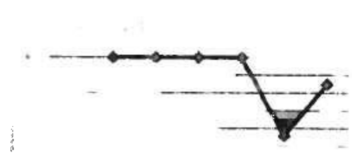


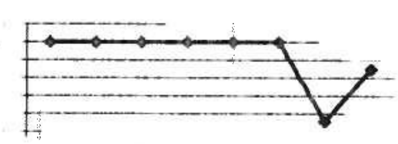


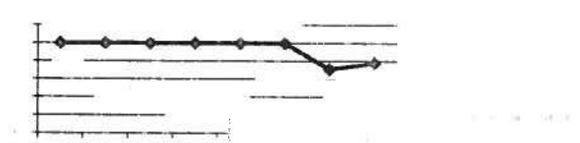


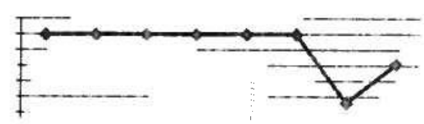


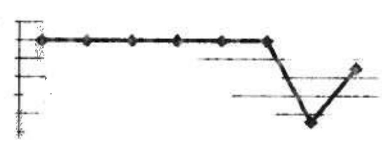


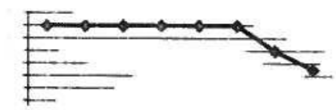


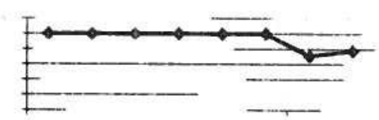


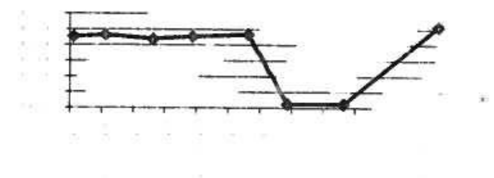


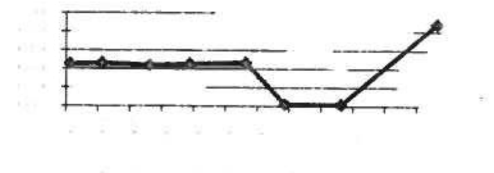


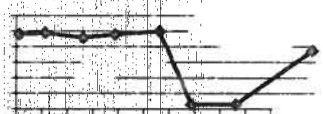


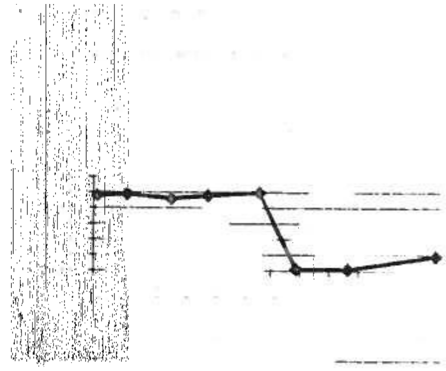


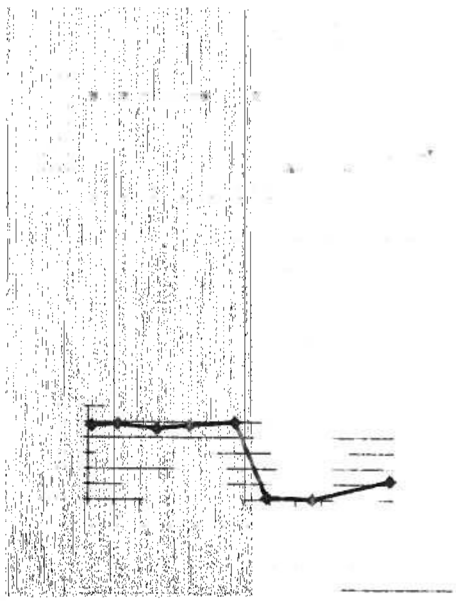


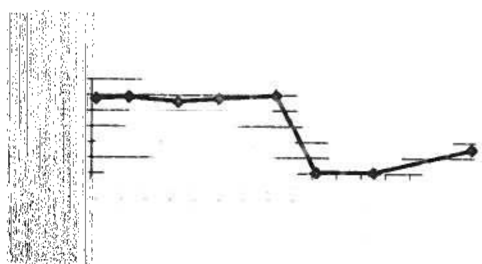


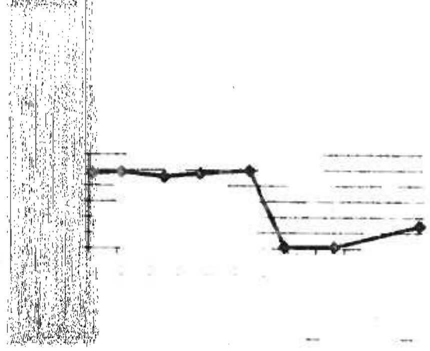


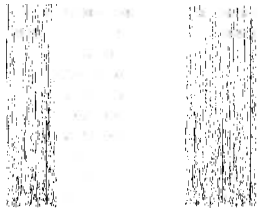


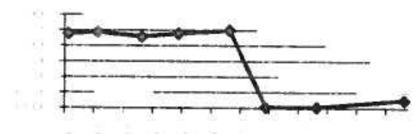


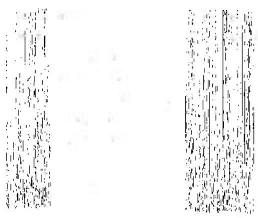


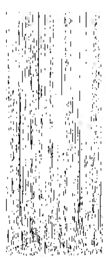


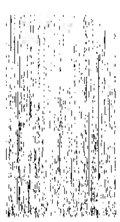


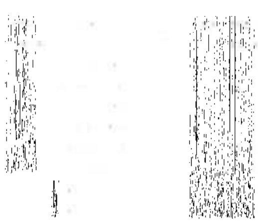


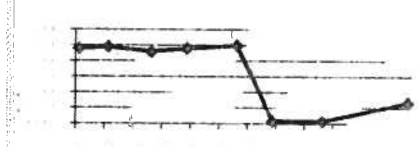


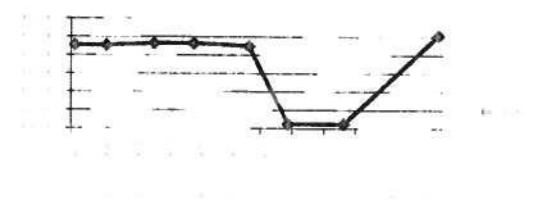


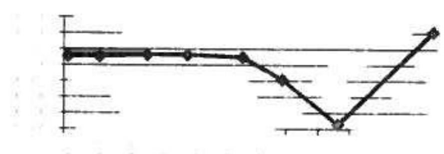


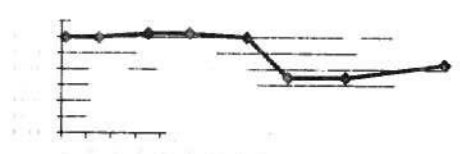


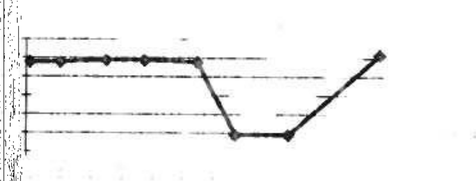


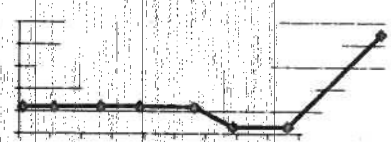


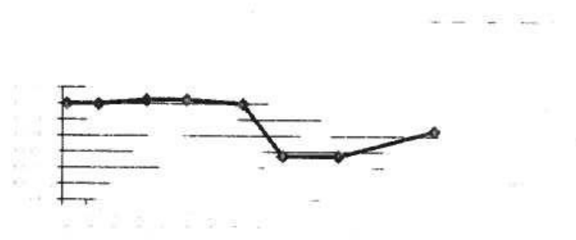


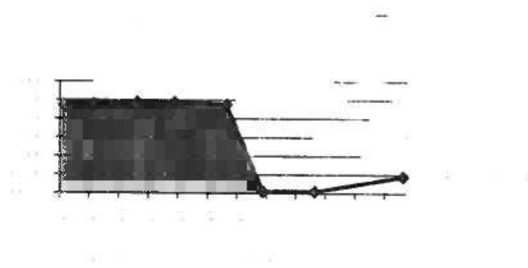


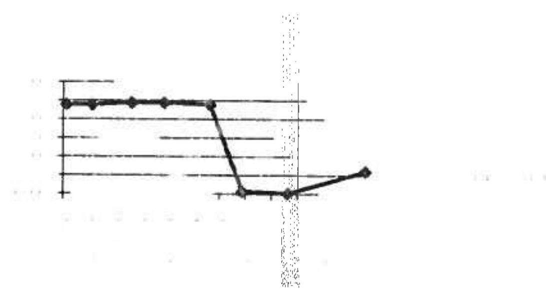


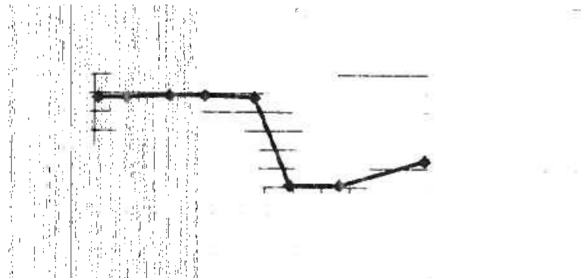


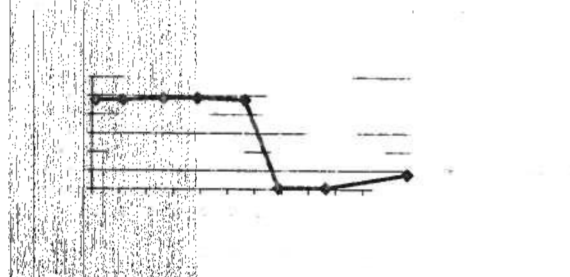


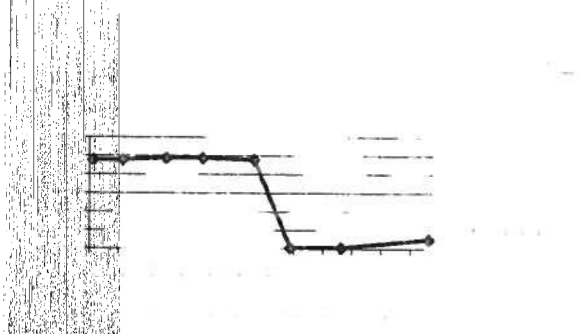


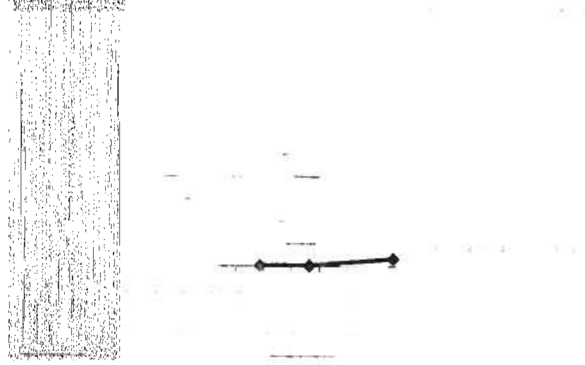


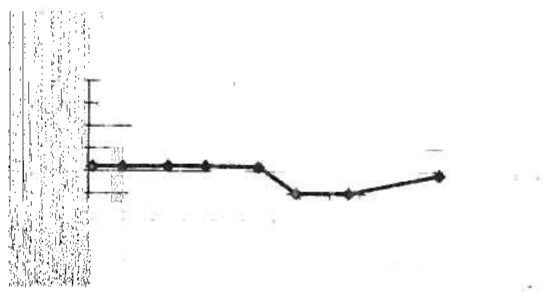


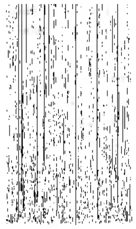


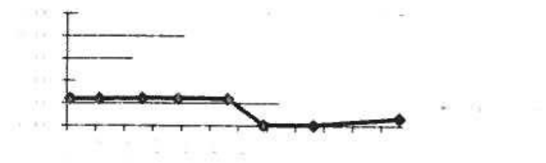


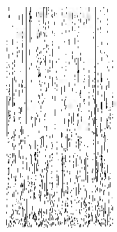


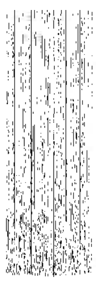


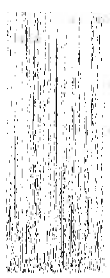


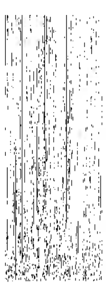


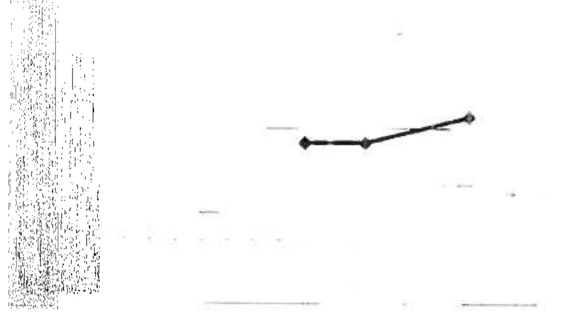


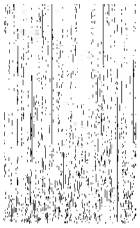


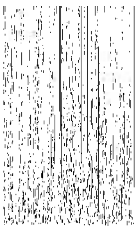
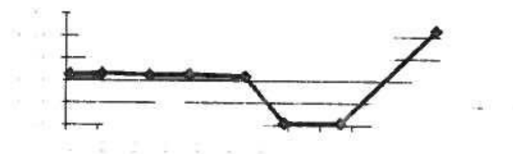
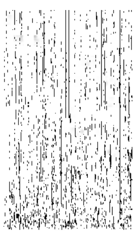
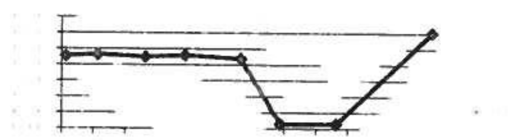
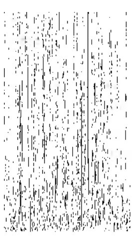


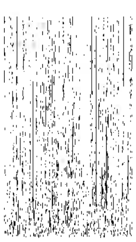


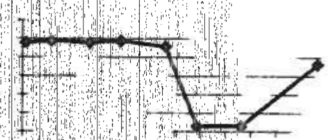


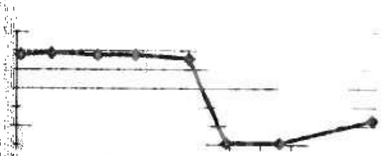


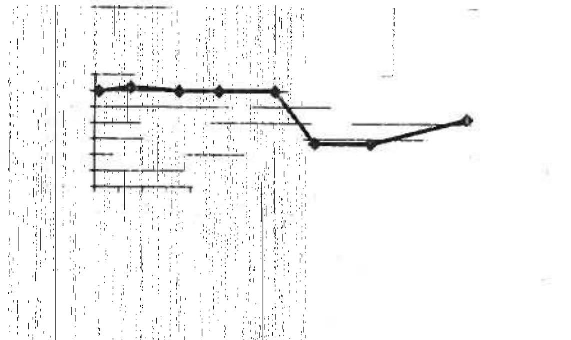


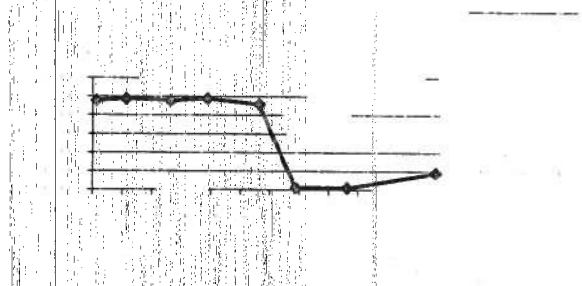






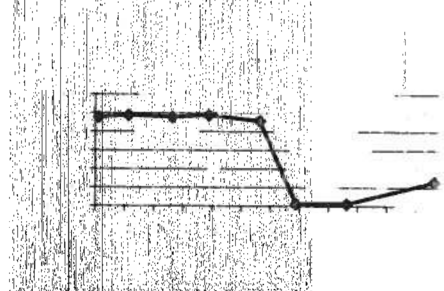


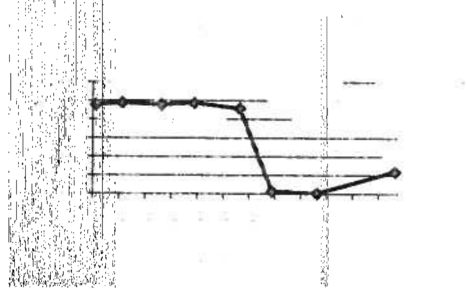



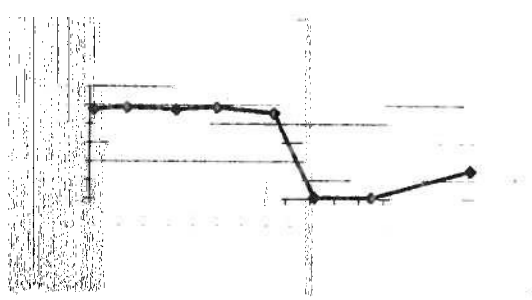


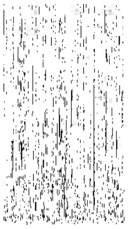
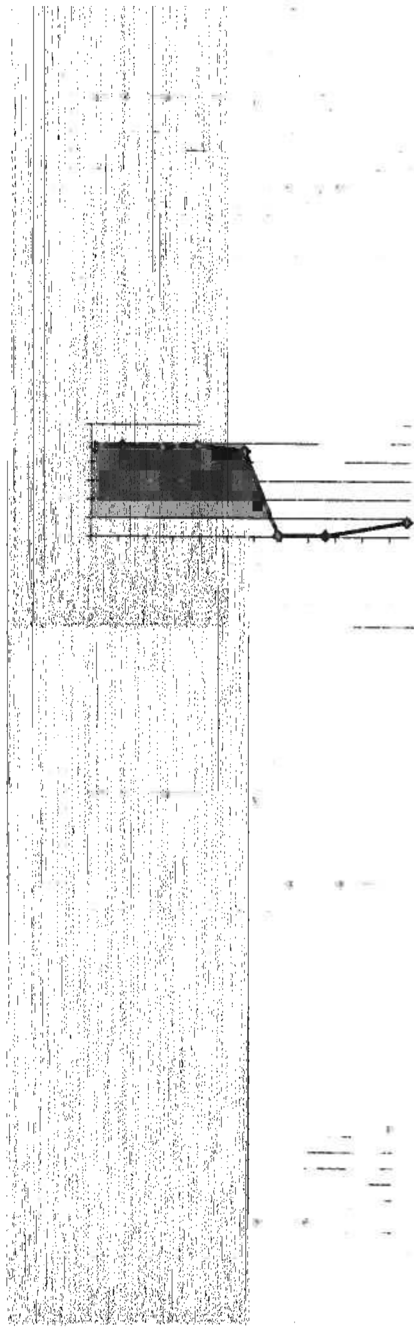
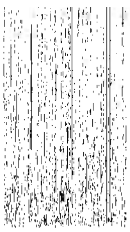
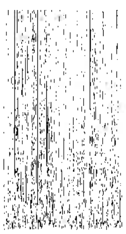
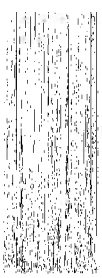
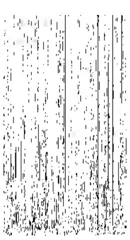
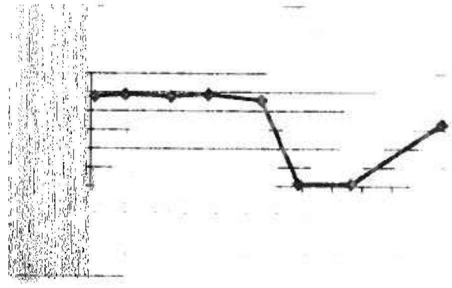


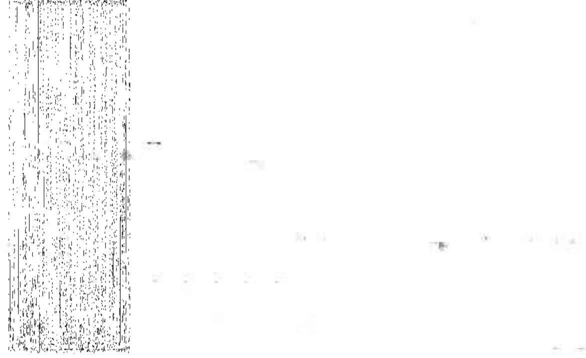


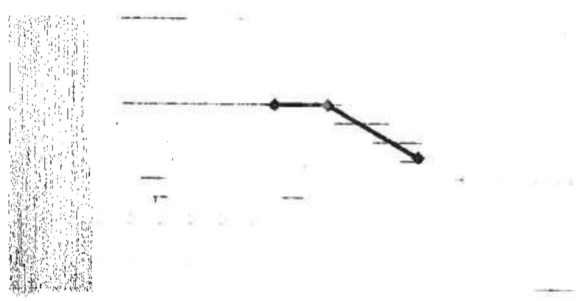


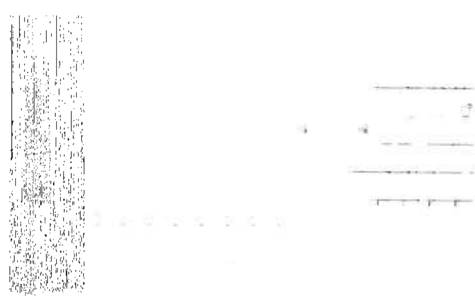


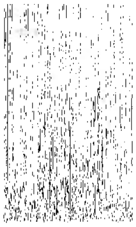


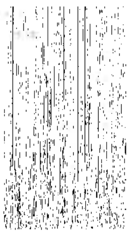








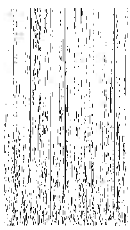


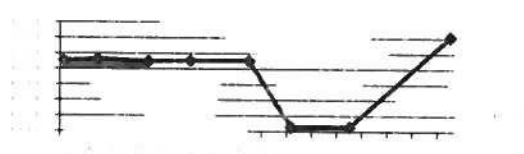


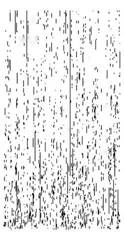


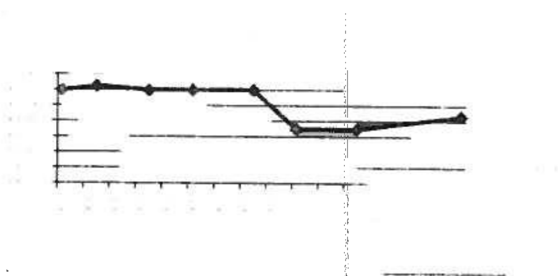


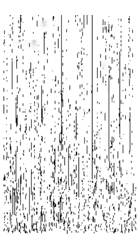


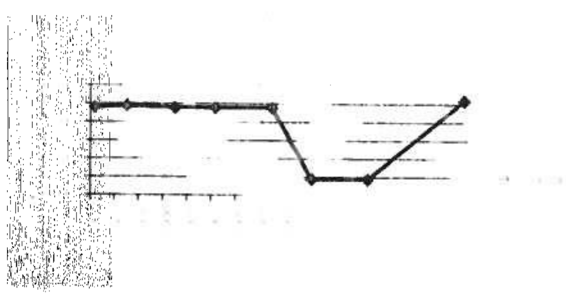


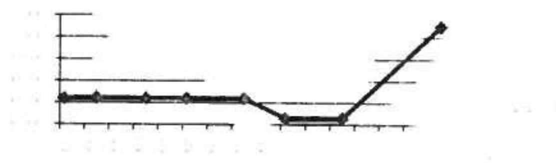


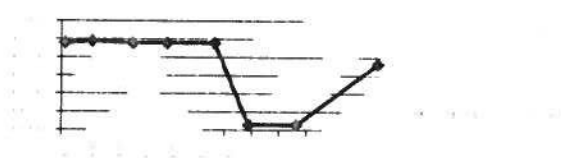


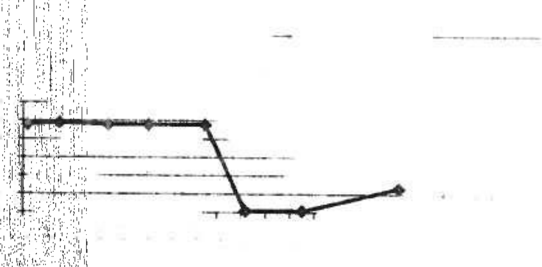


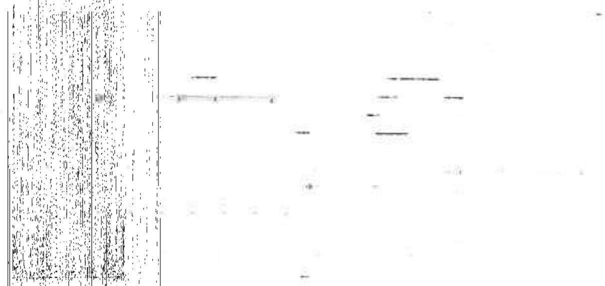


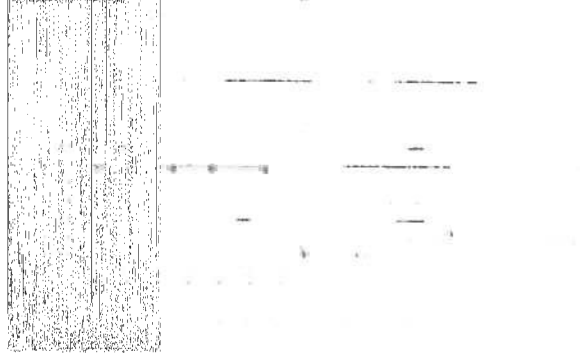


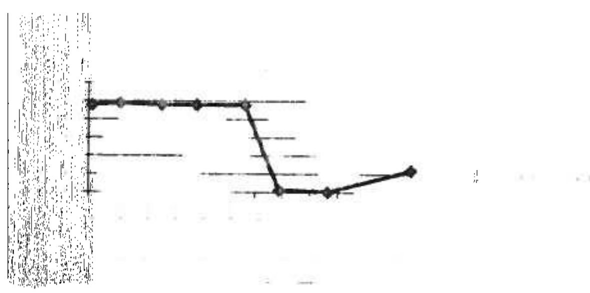


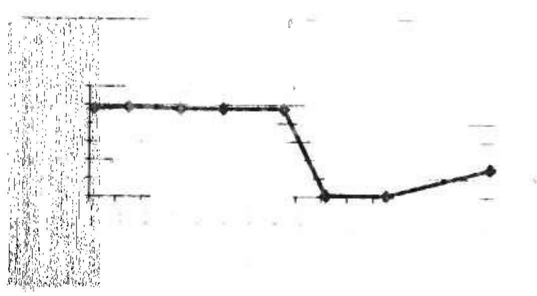


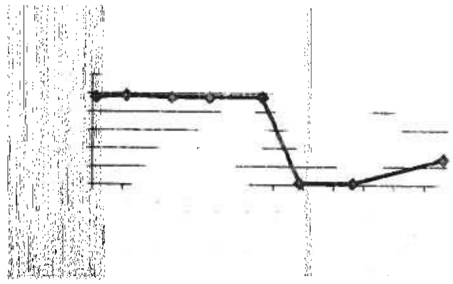


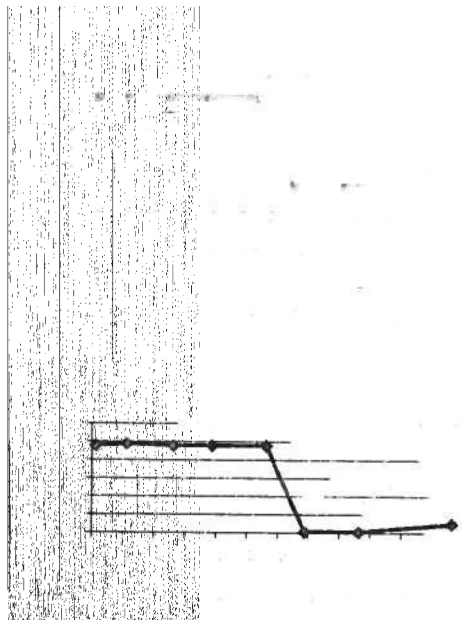


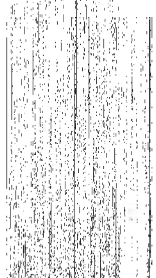


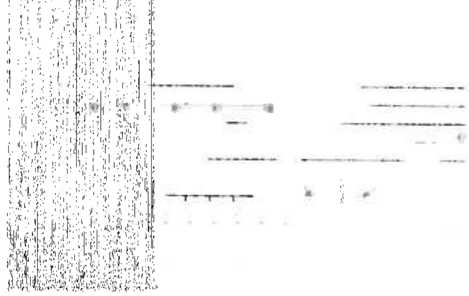


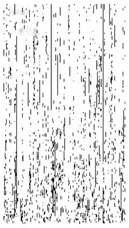


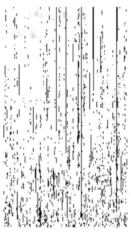


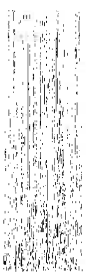


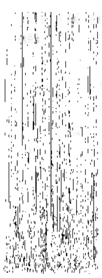


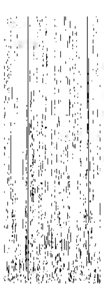


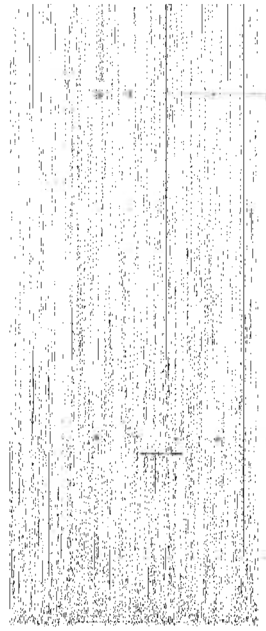


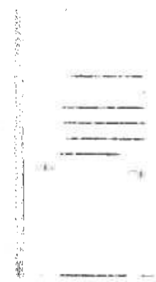


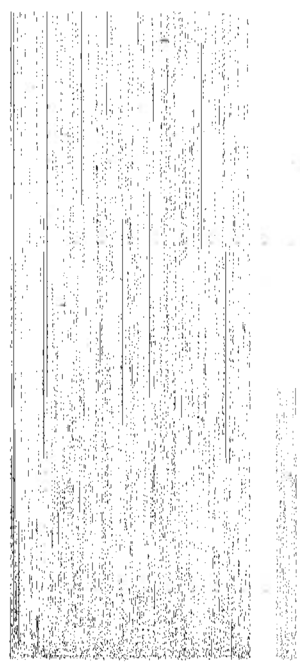


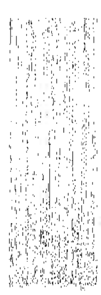


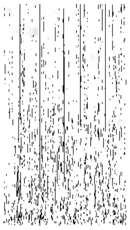


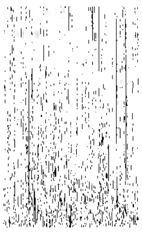
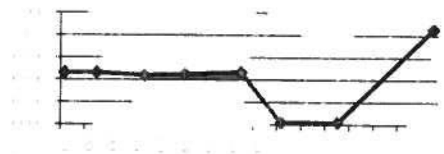
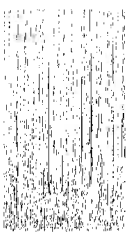
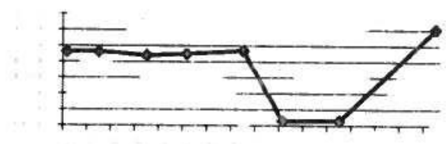
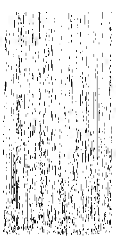


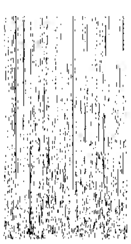


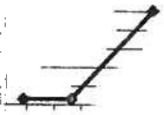


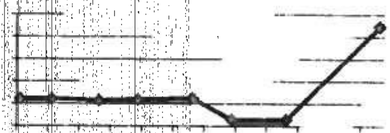


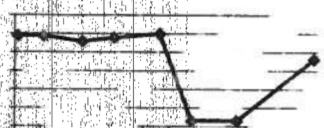


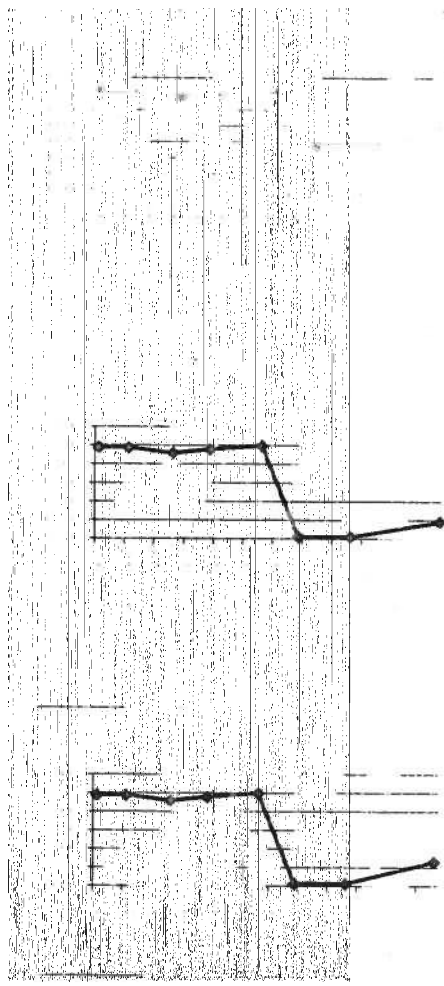






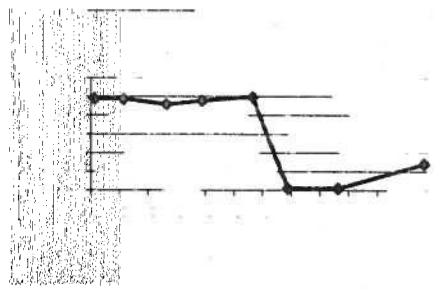


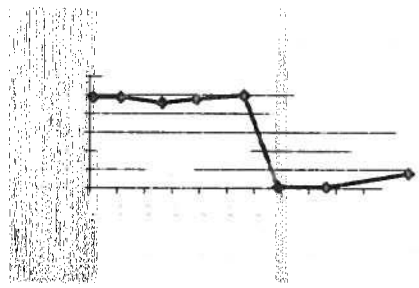



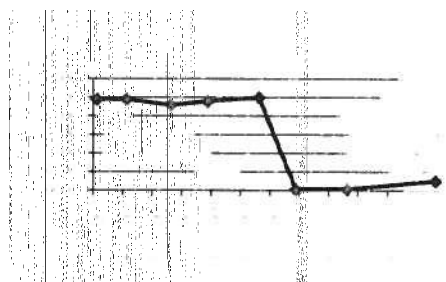


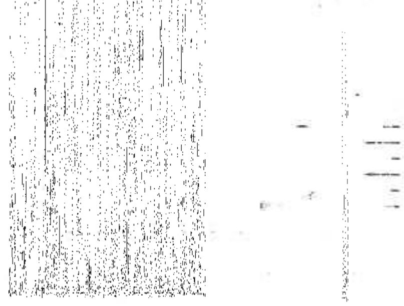


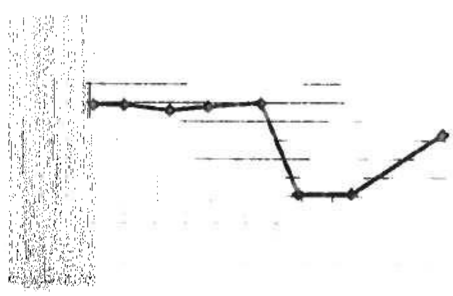


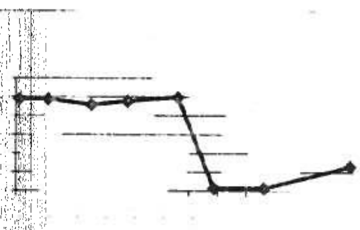


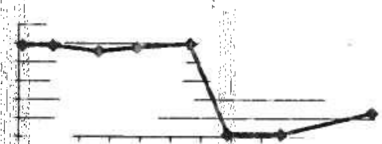


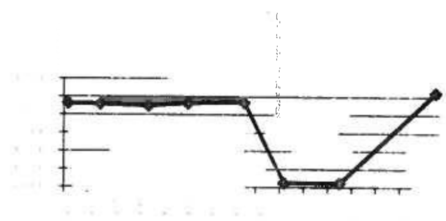


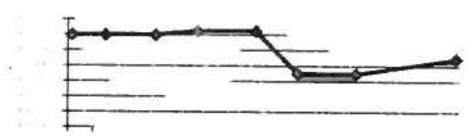


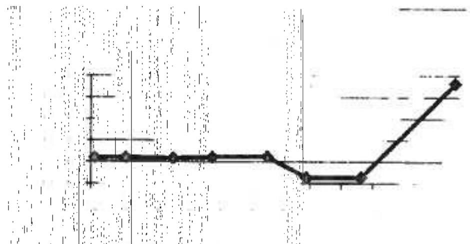


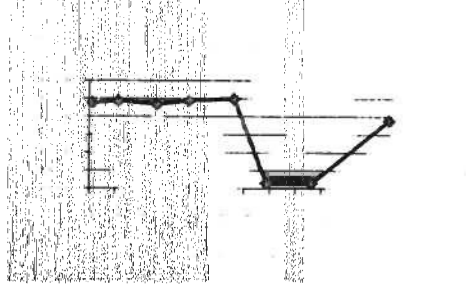


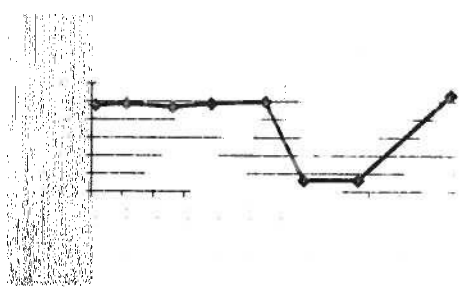


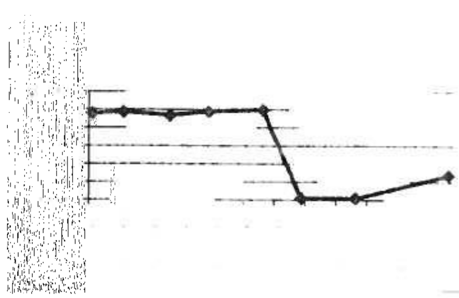


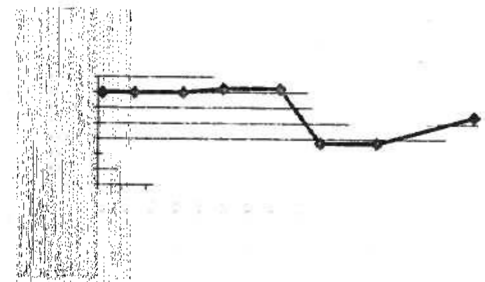


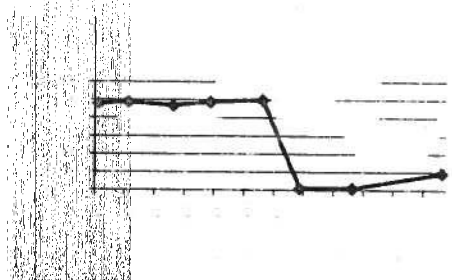


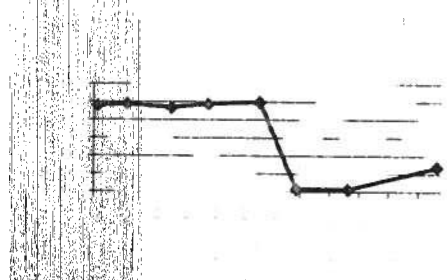


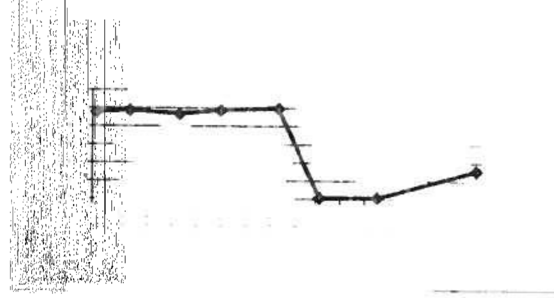


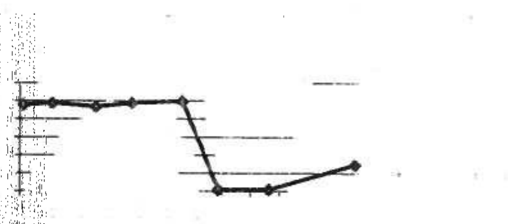


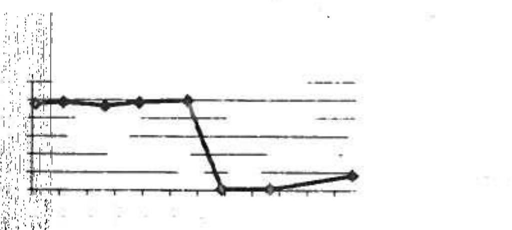


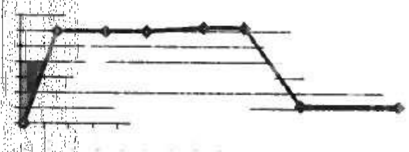


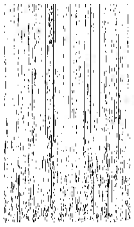
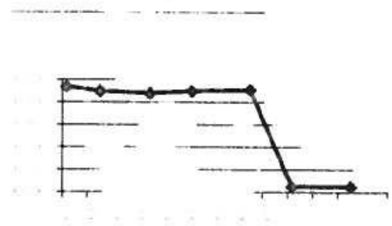
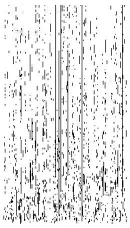


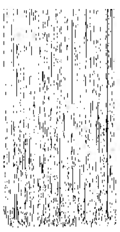


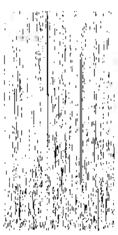


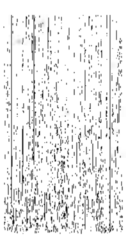
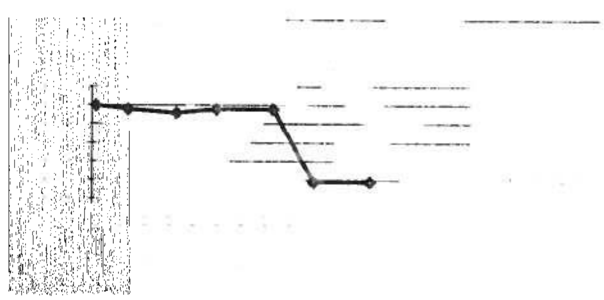


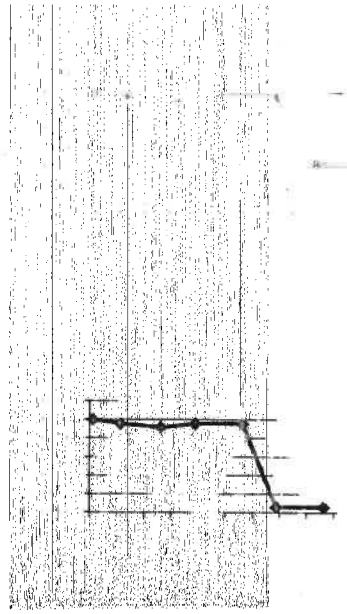


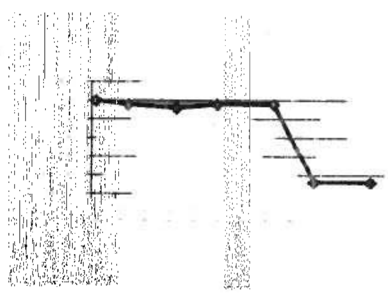




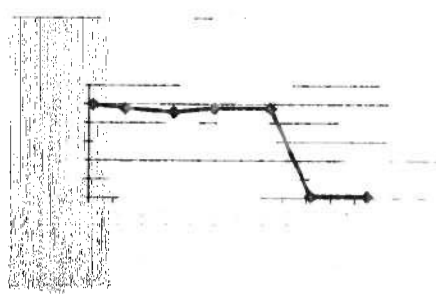


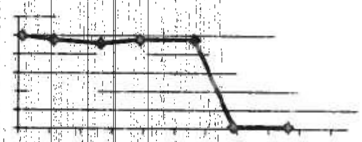


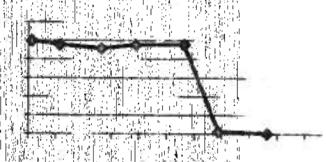



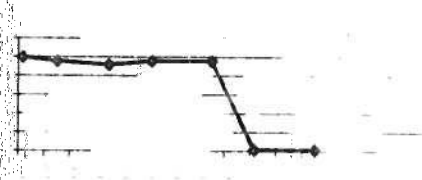


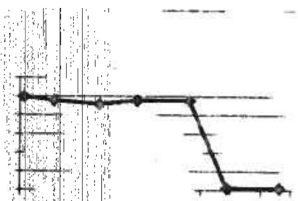


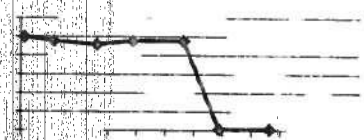


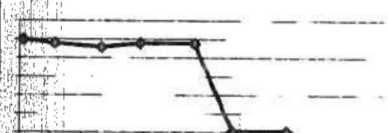


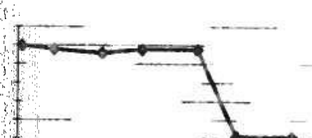


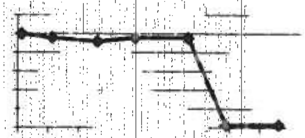


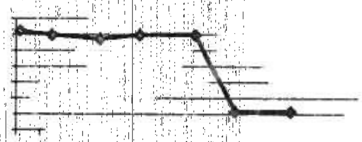


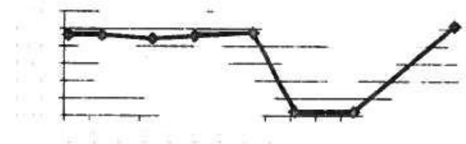


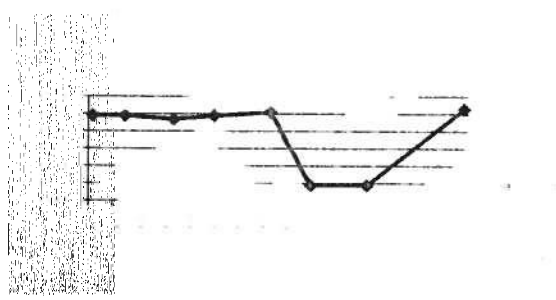


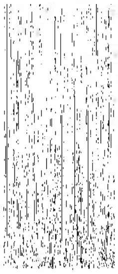


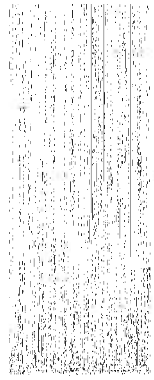


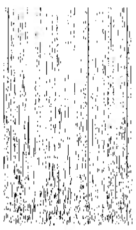


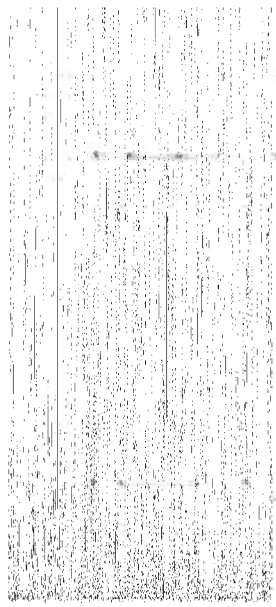


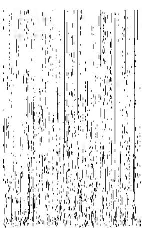


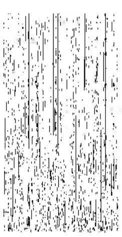


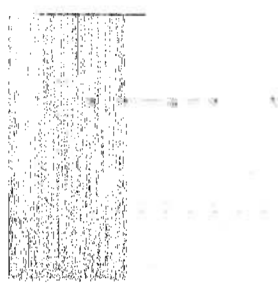


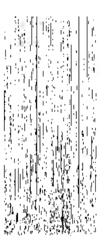


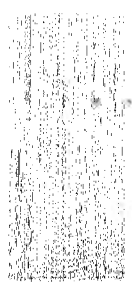


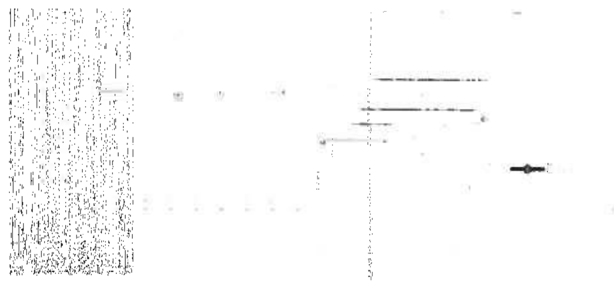


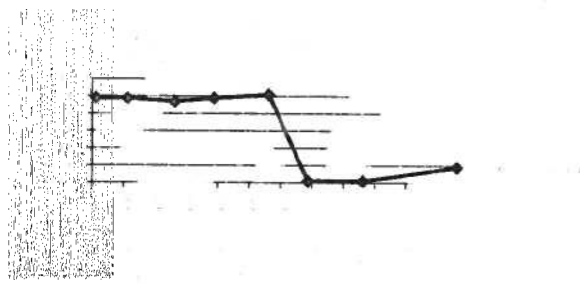


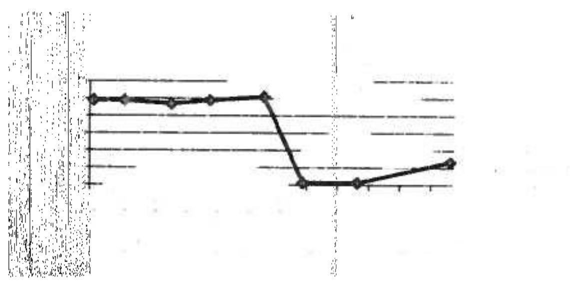


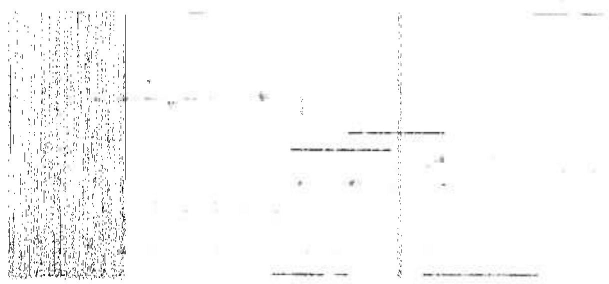


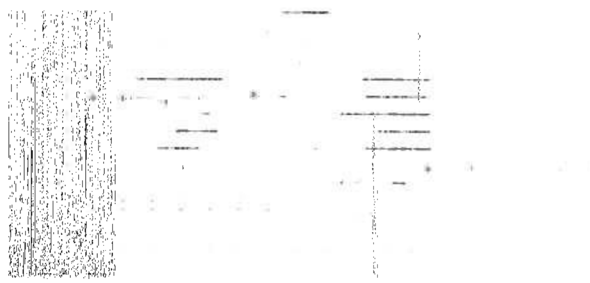


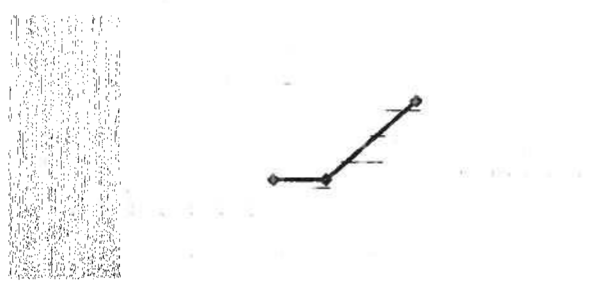


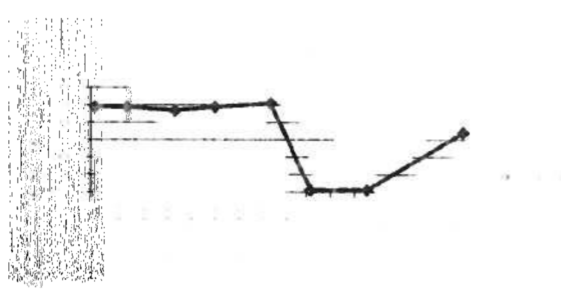


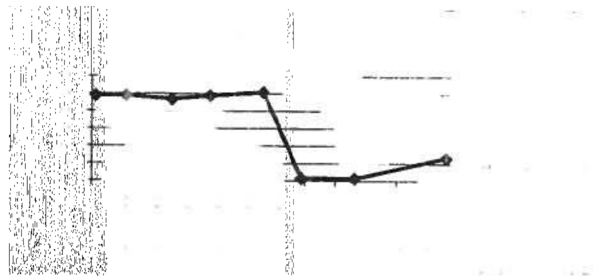


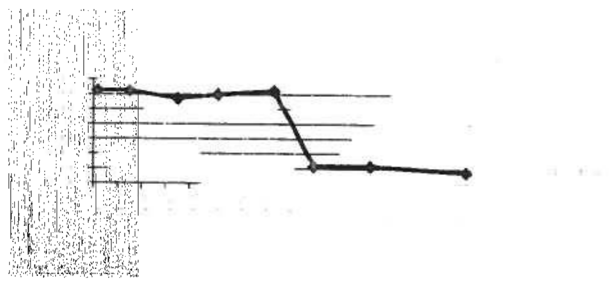


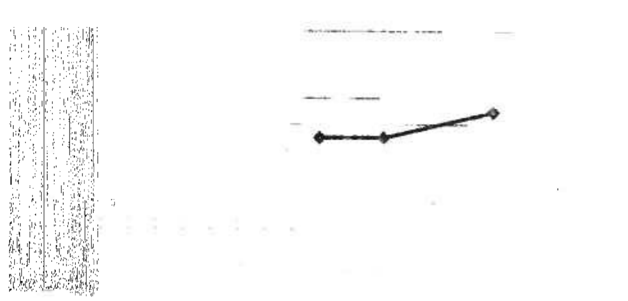


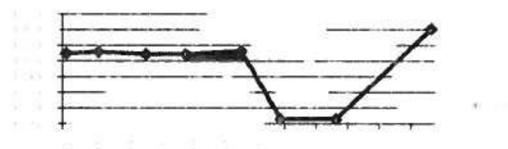


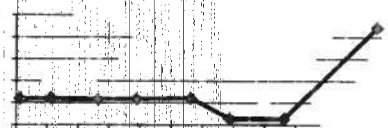


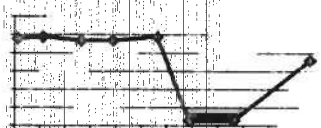


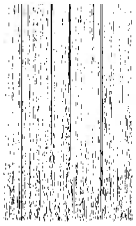


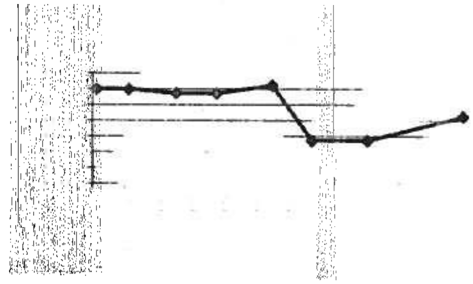


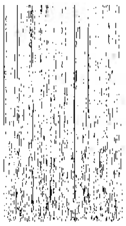


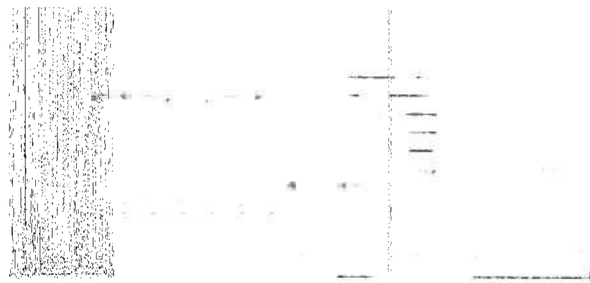


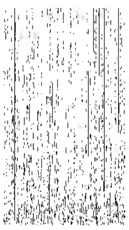


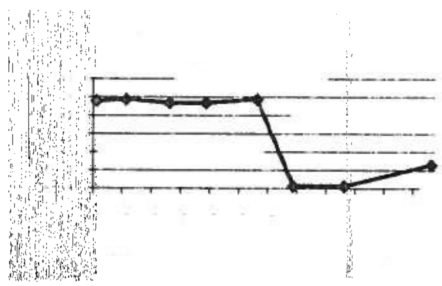


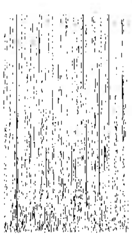


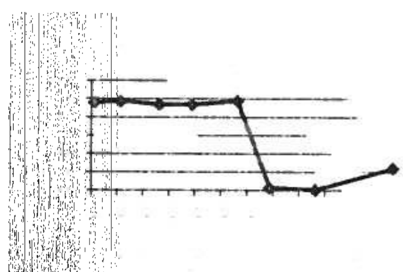


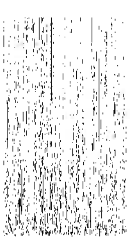


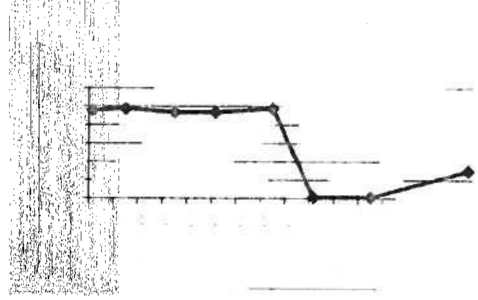


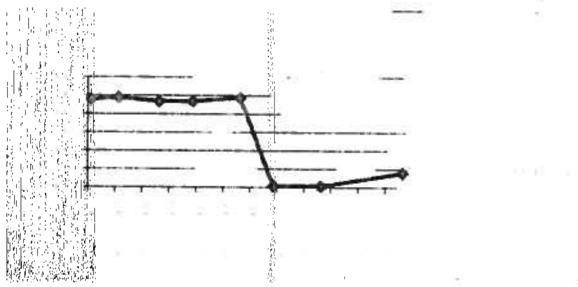


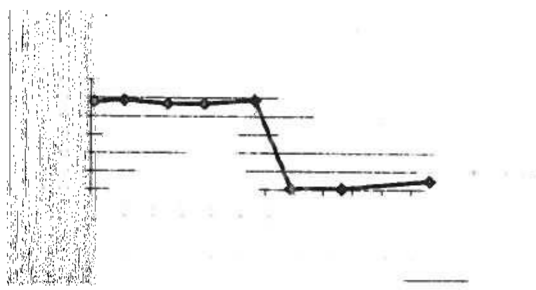


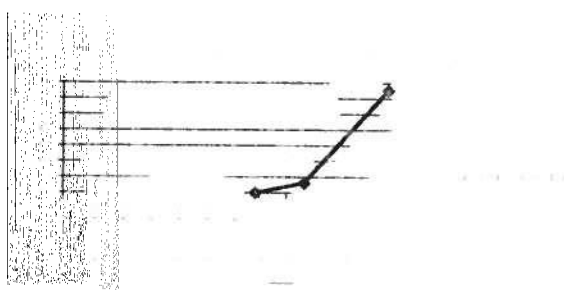


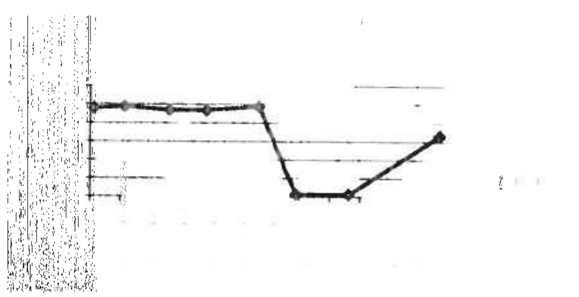


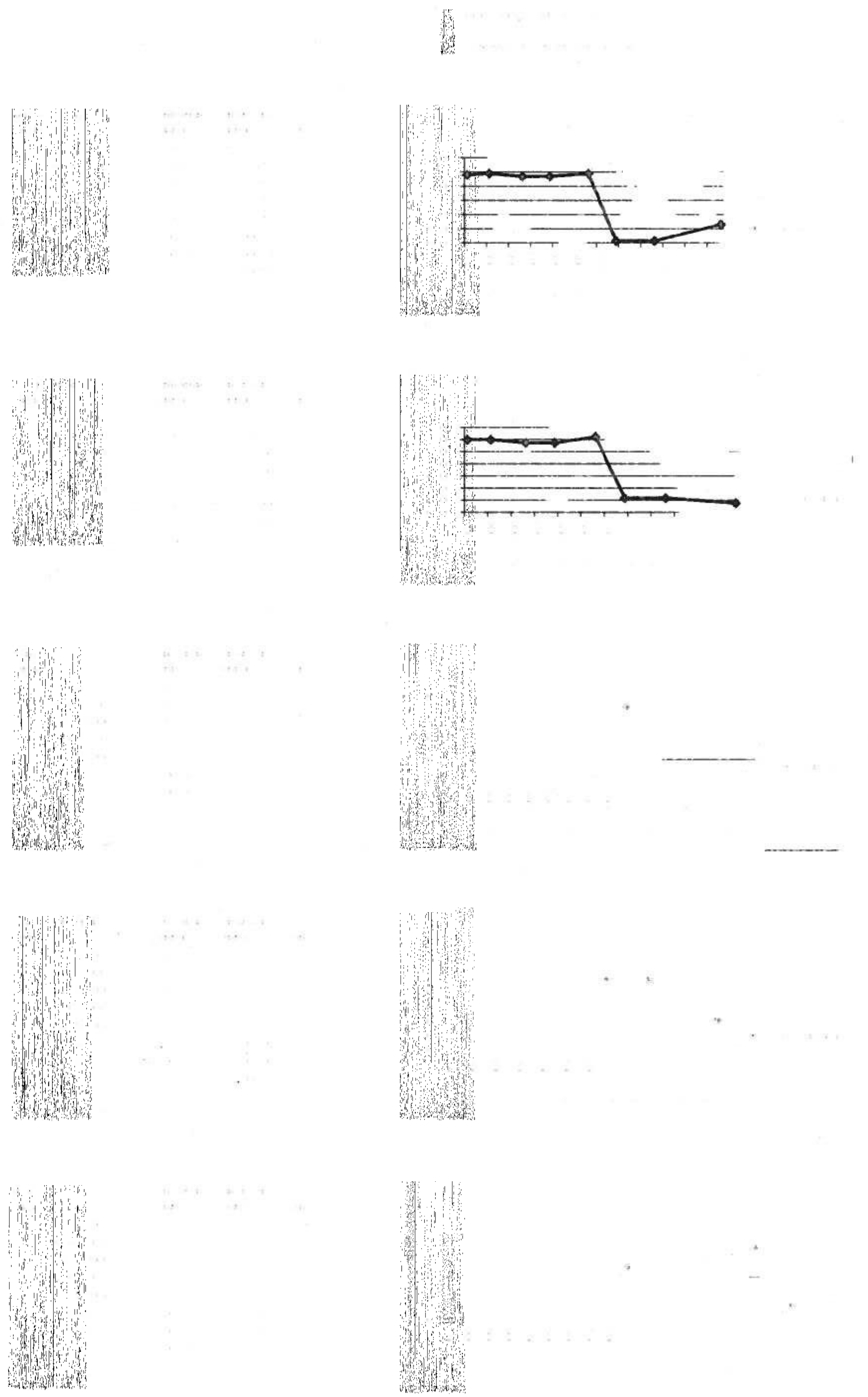


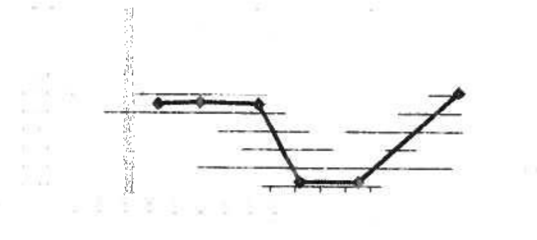


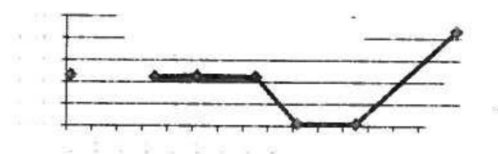


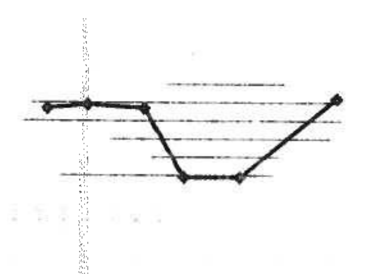


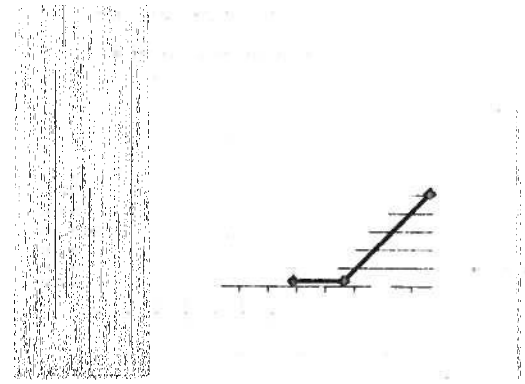


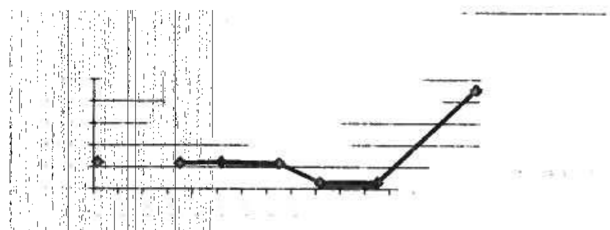


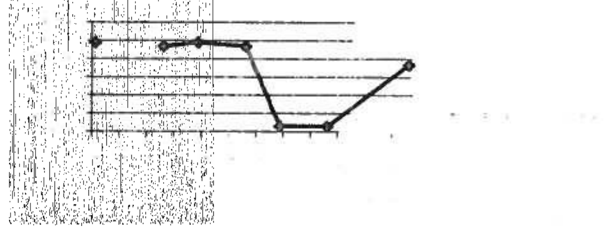


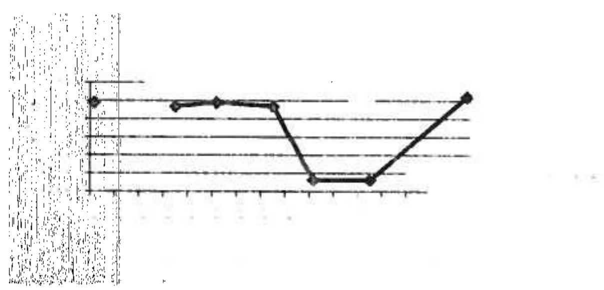


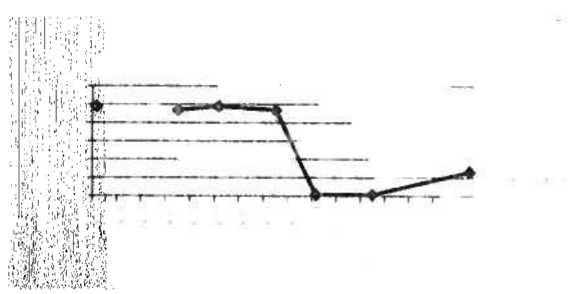


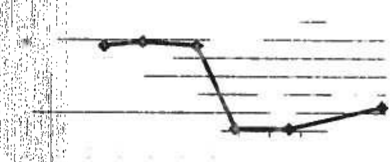


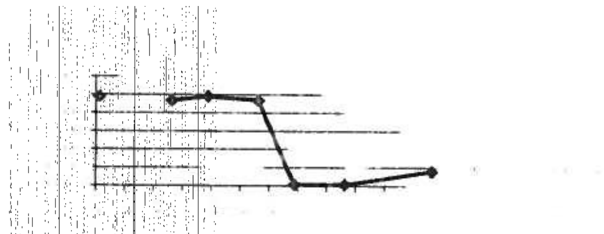


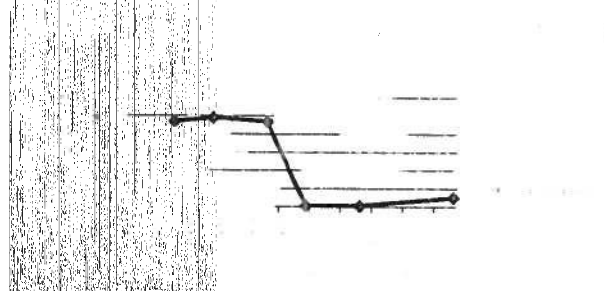


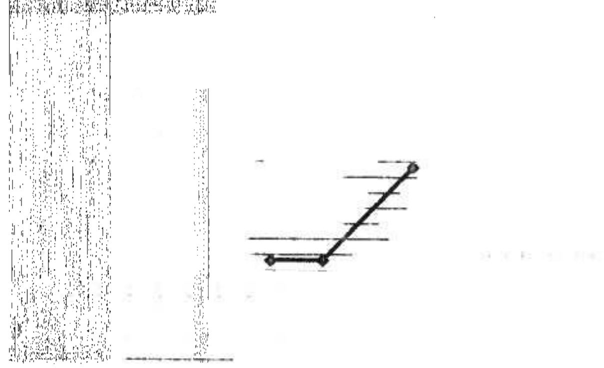


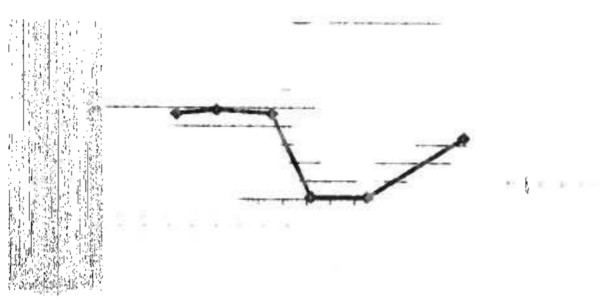


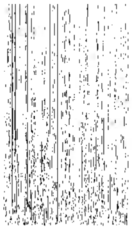


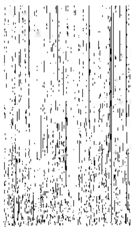


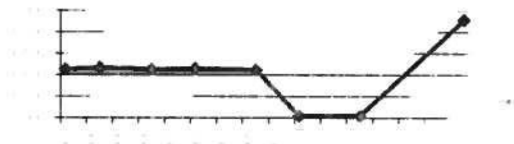


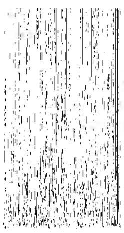


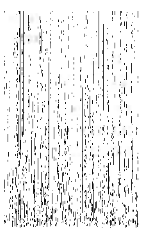


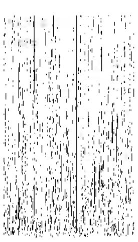


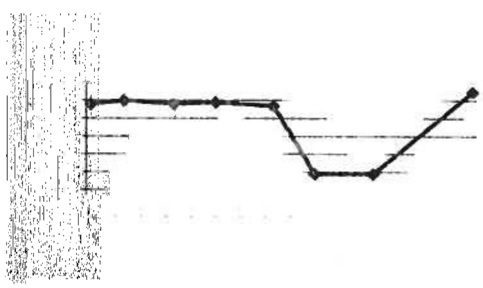


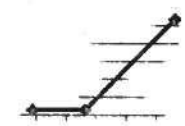


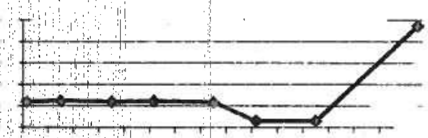


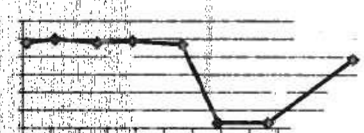


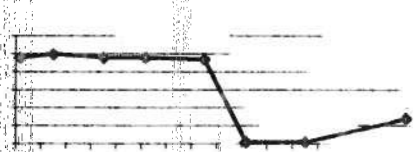


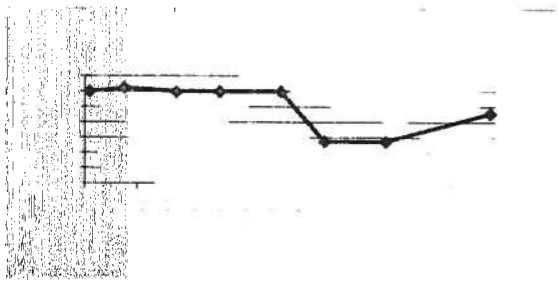


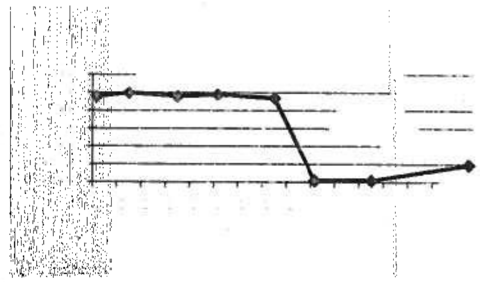


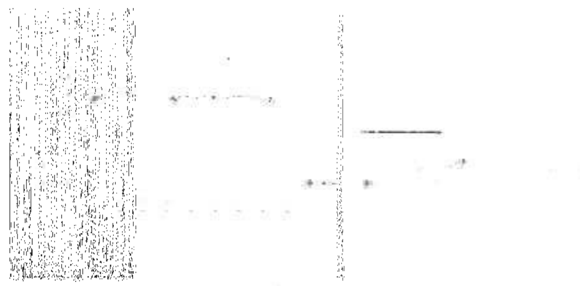


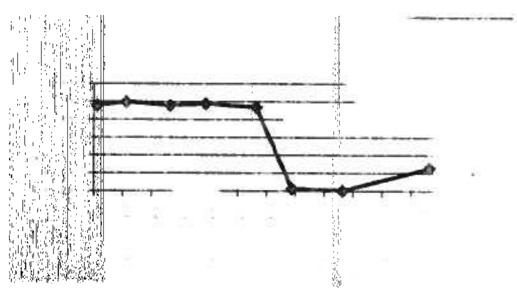


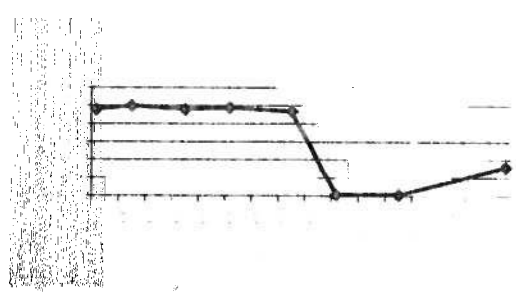


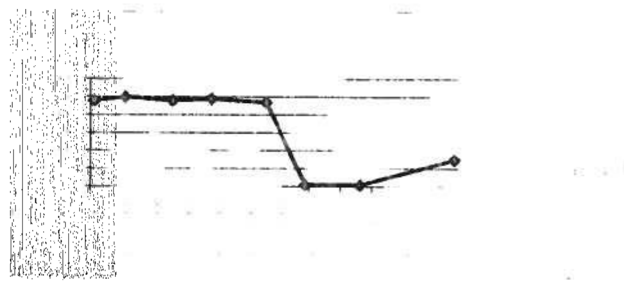


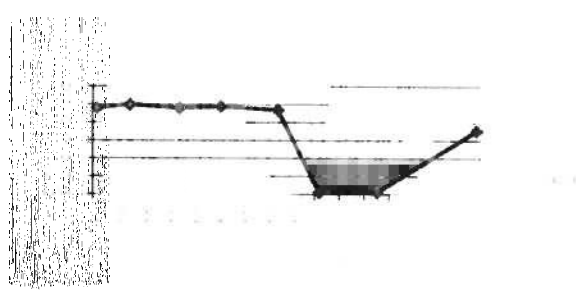


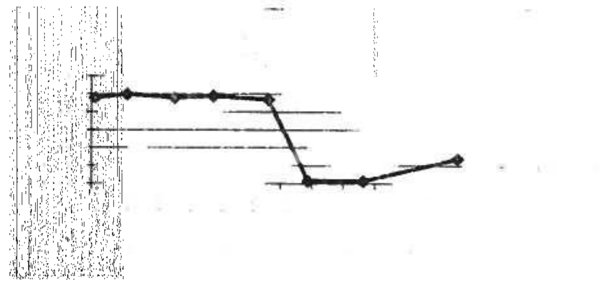


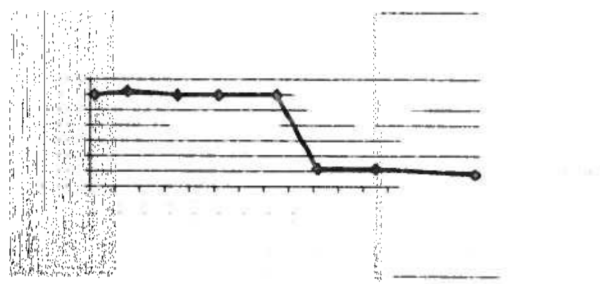


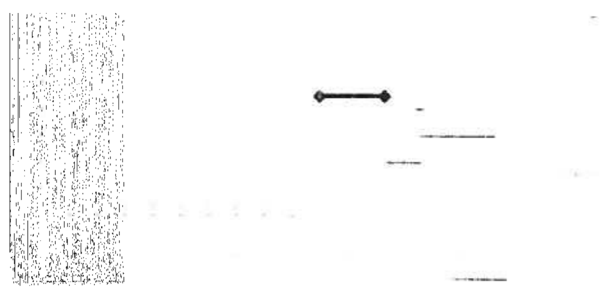


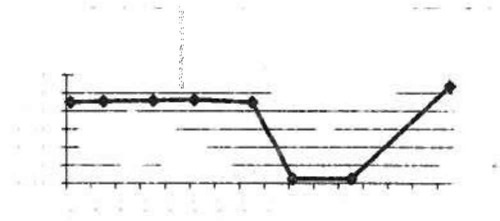


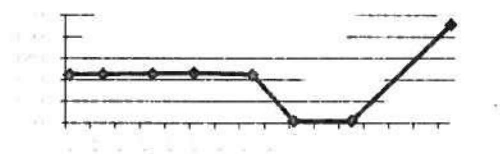


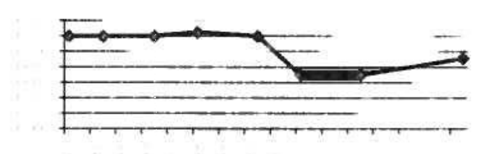


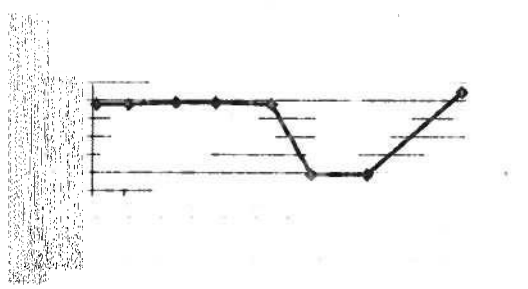


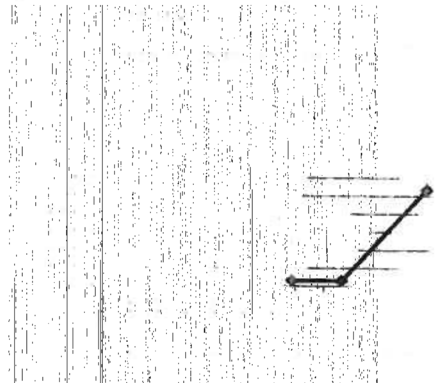


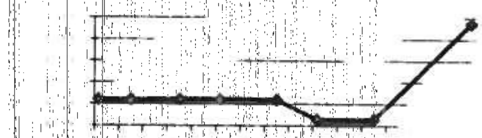


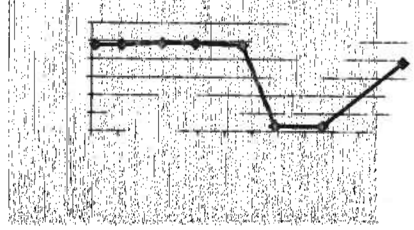


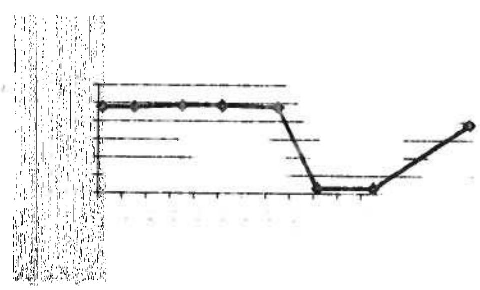


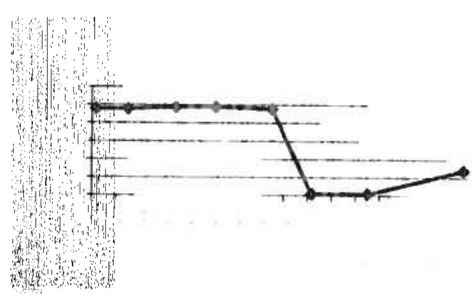


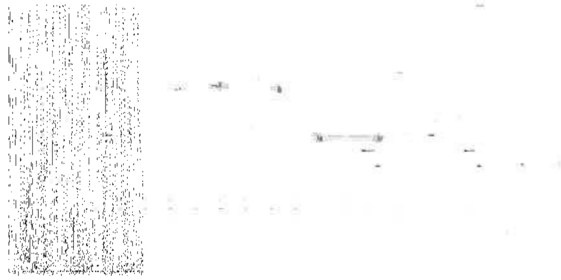


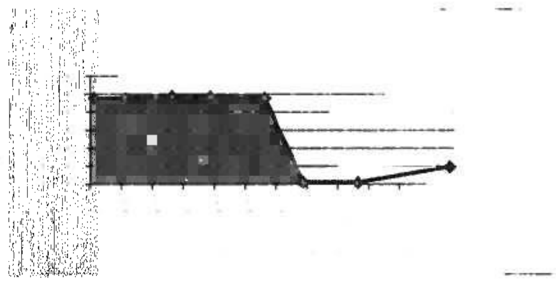


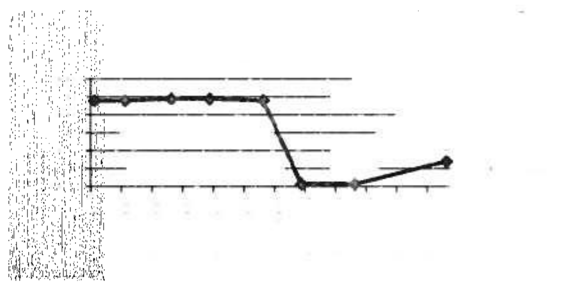


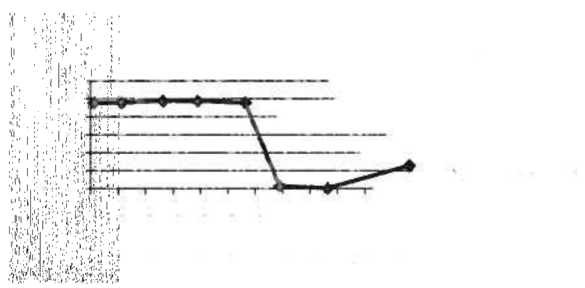


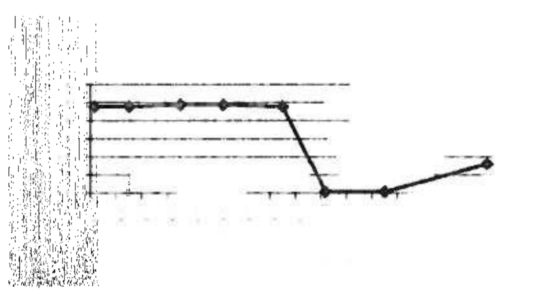


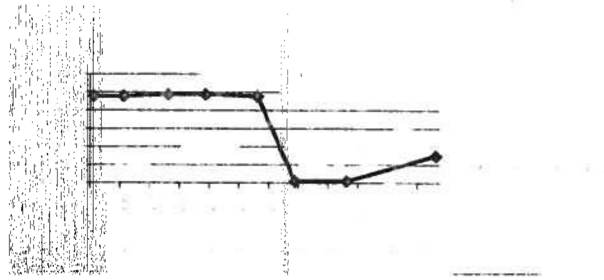


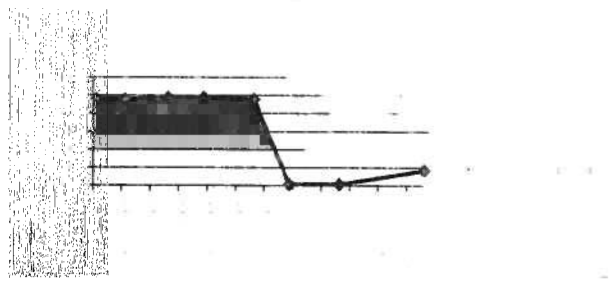


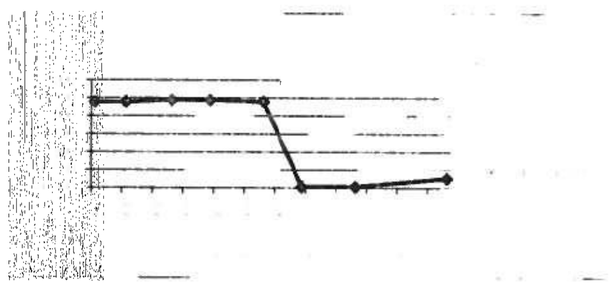


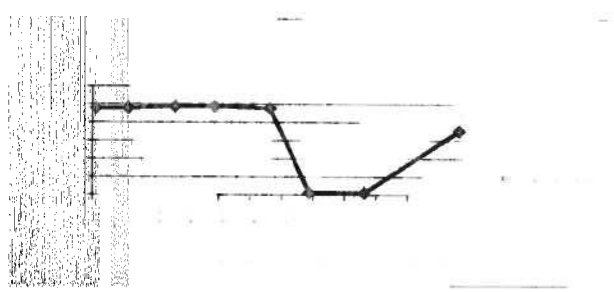


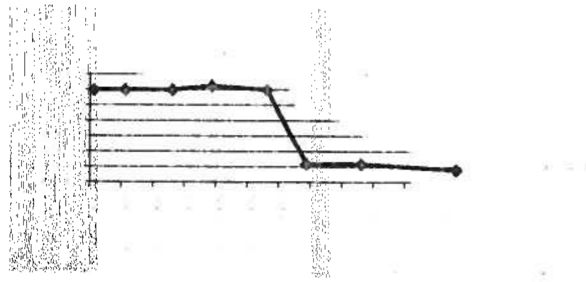


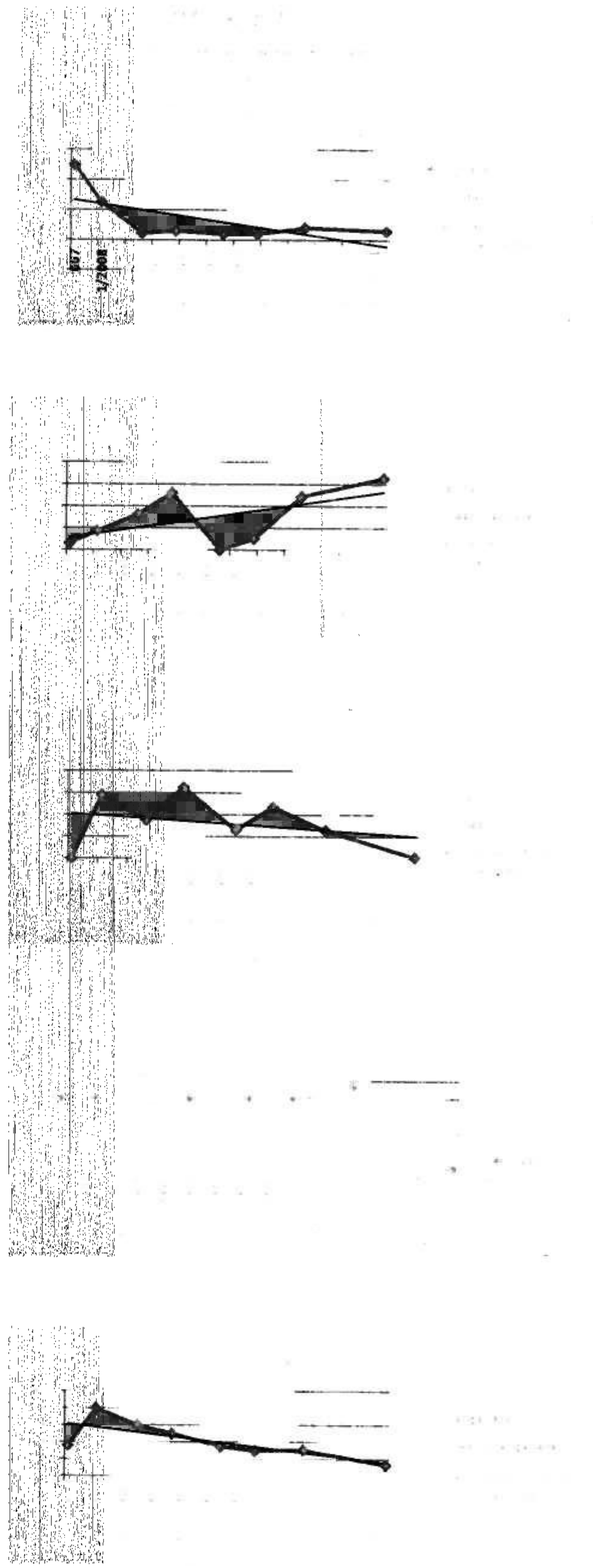


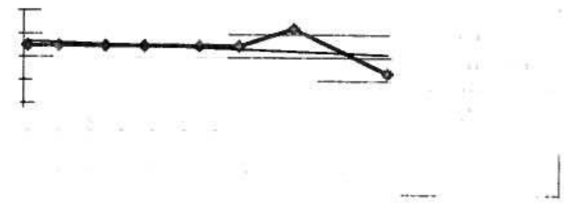


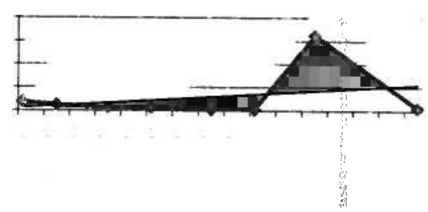


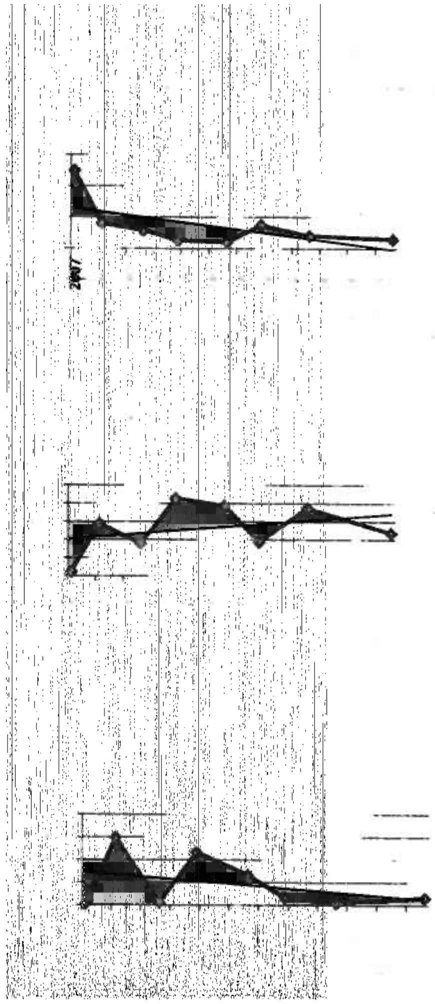


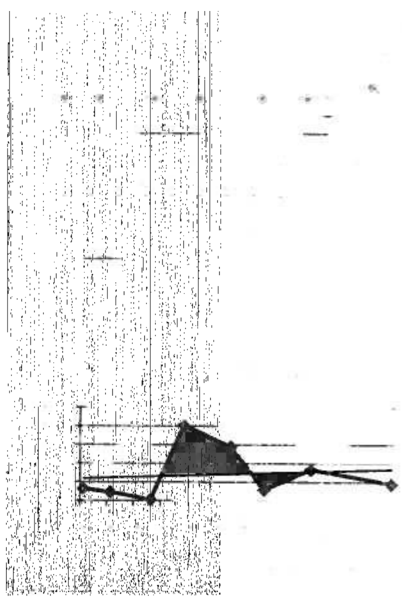


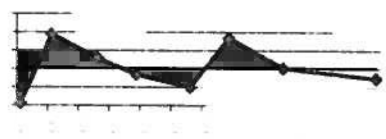


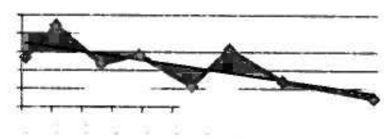


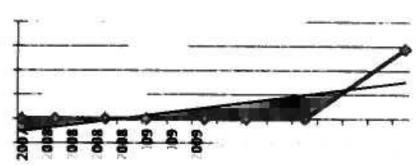


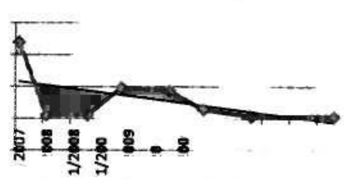

2007

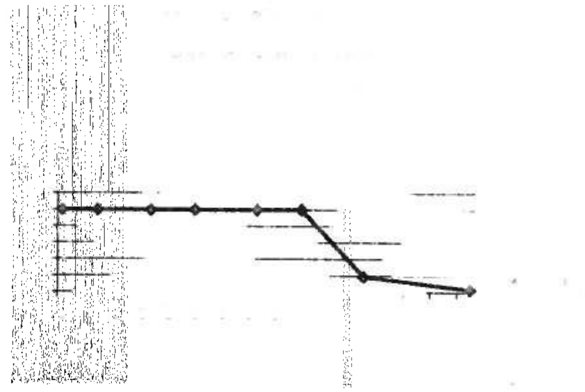


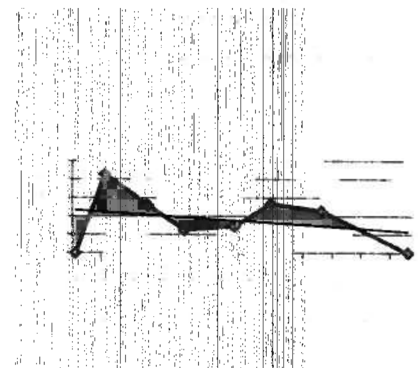


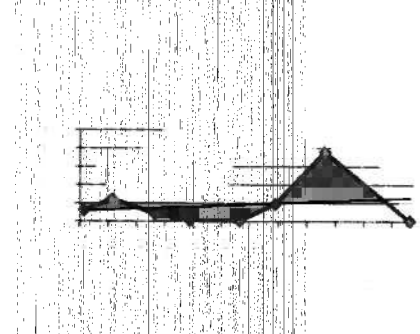


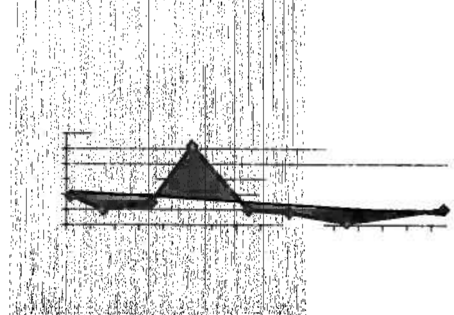


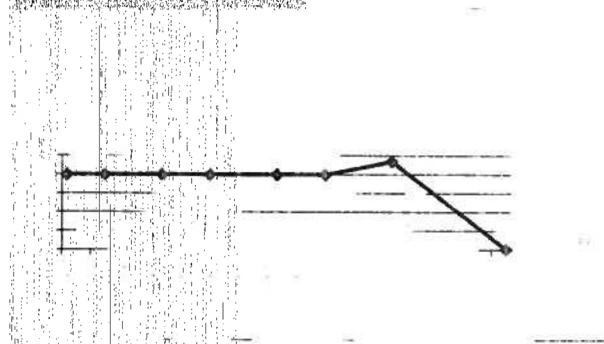


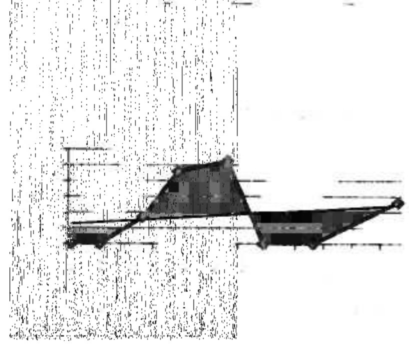


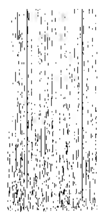


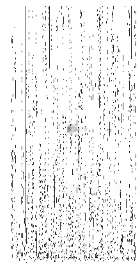


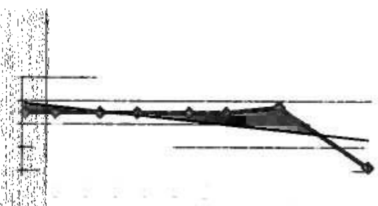


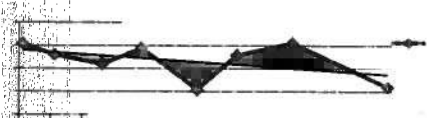


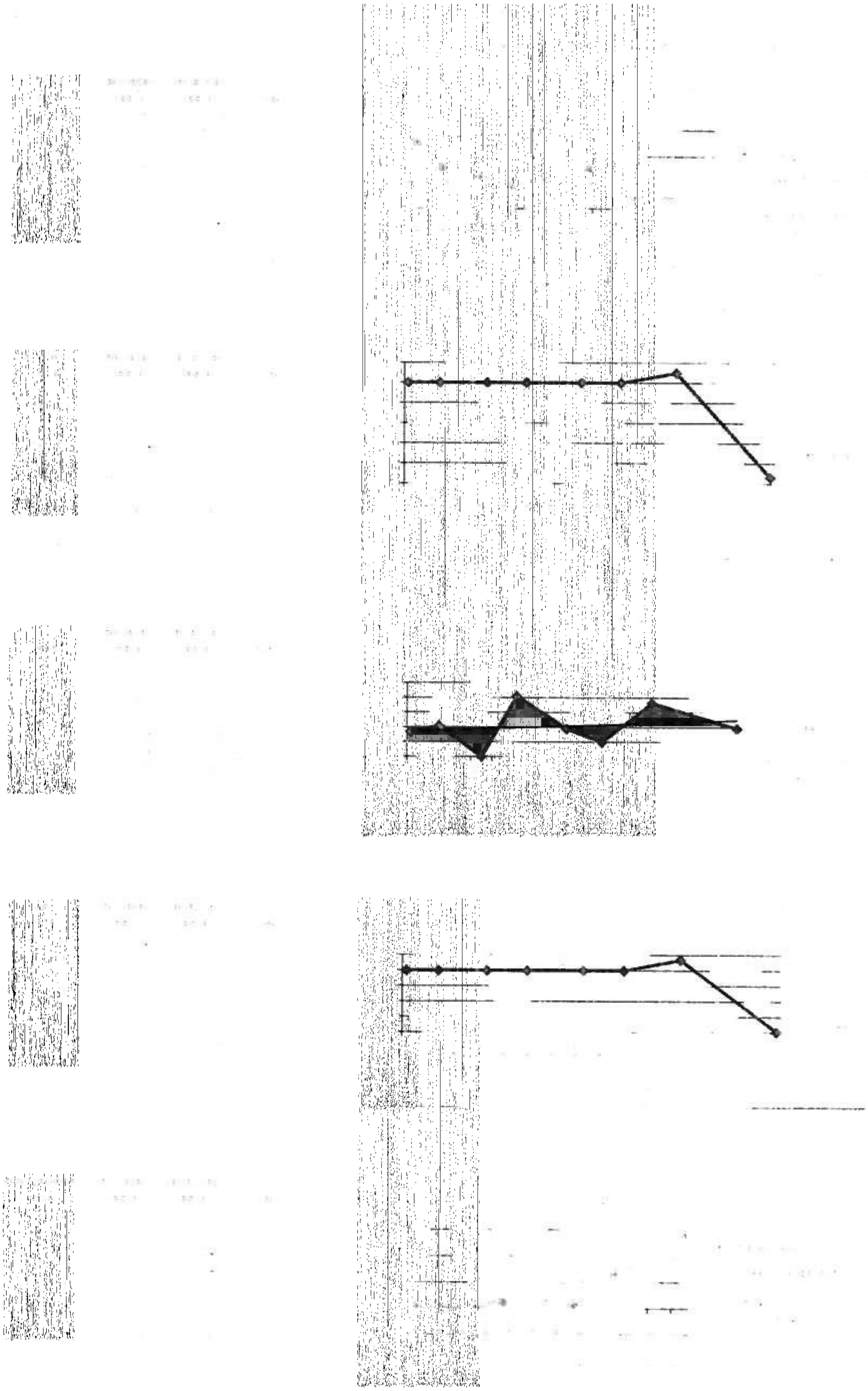


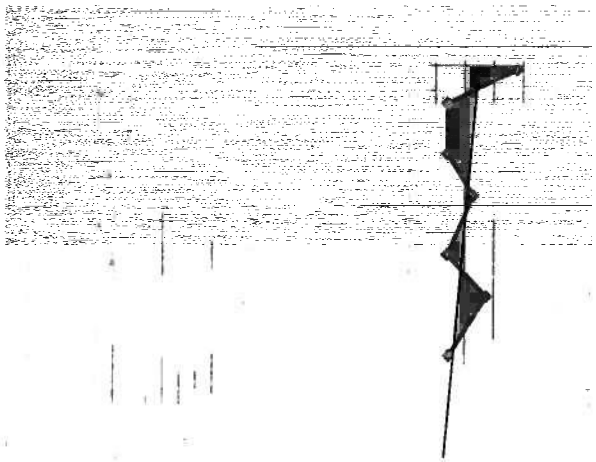
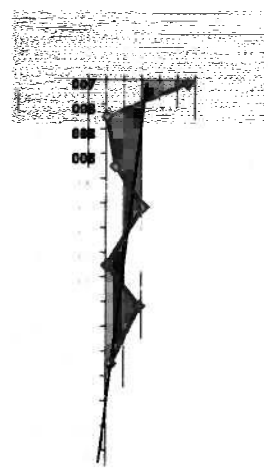
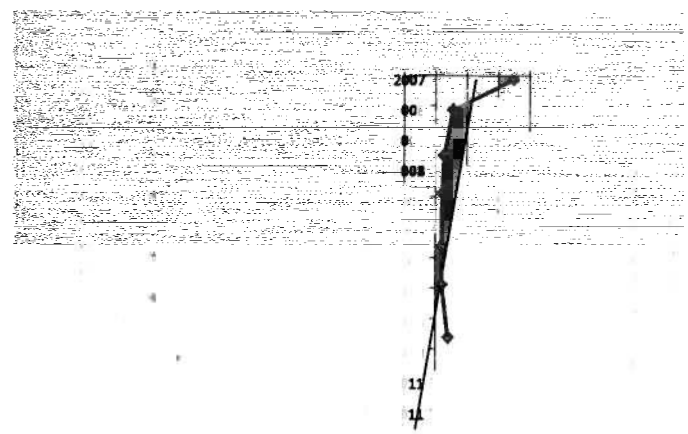


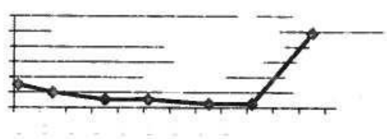


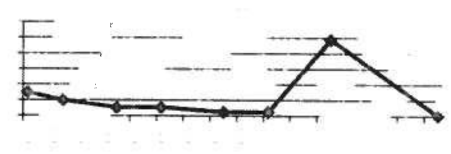


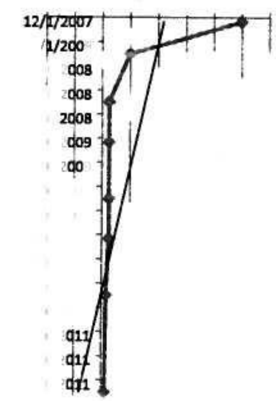




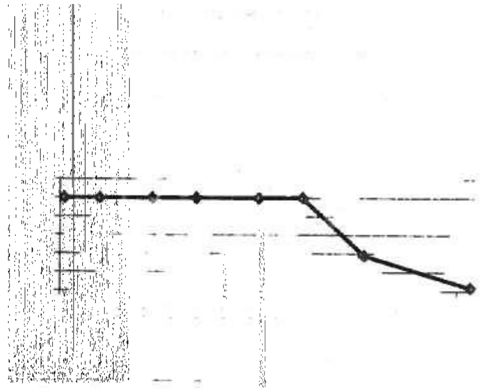



2007

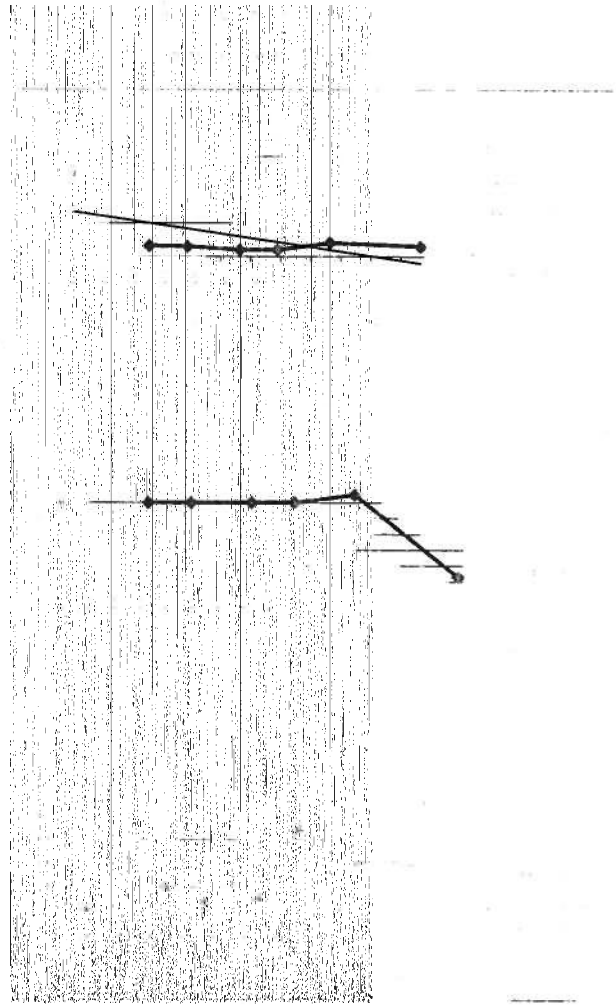


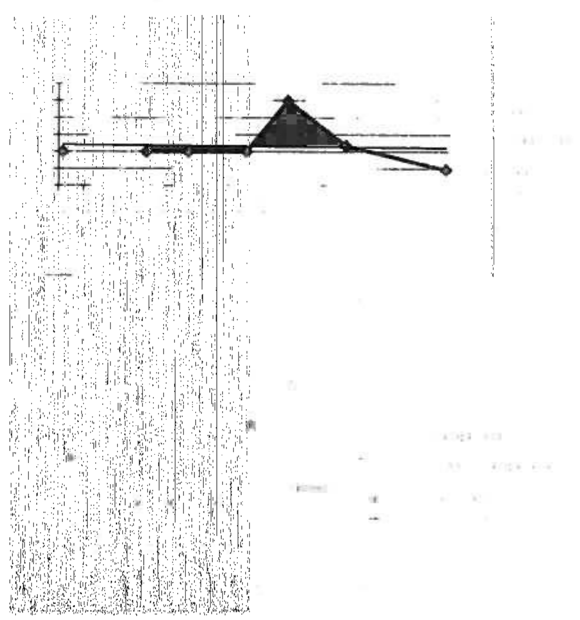


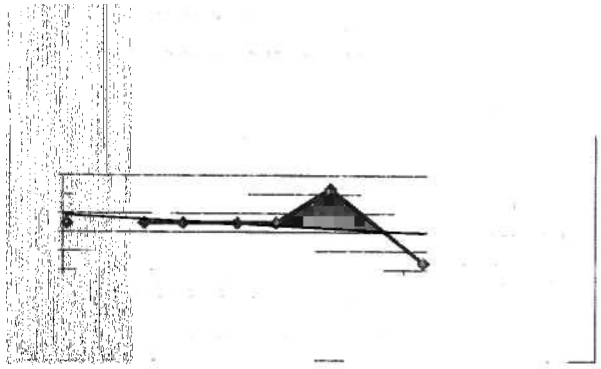


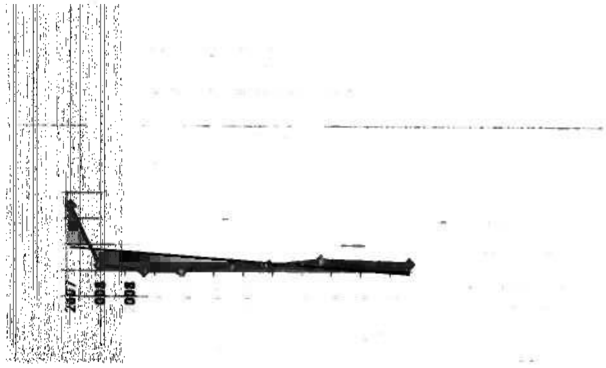
12/1/2007
1/200
008
008
2008
009
00
011
011
011

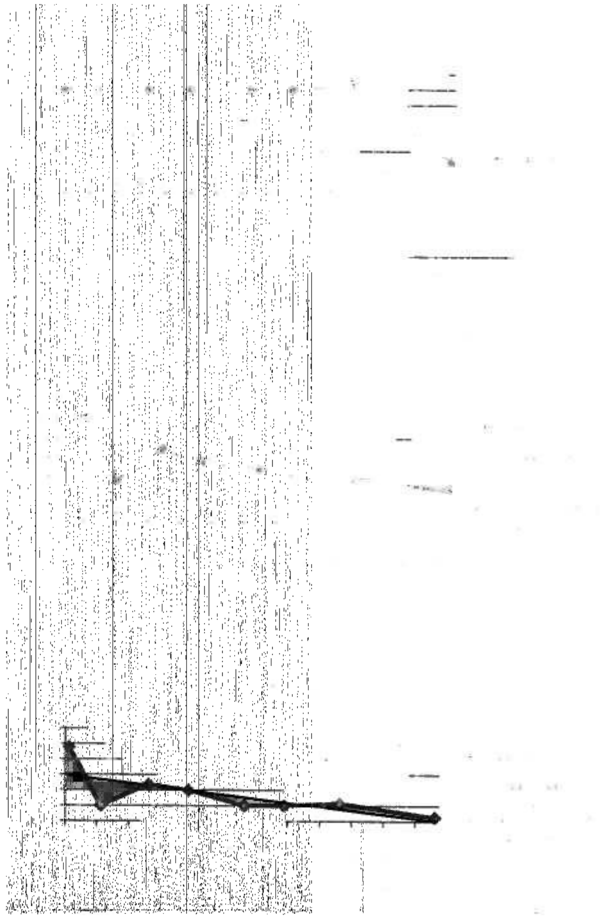


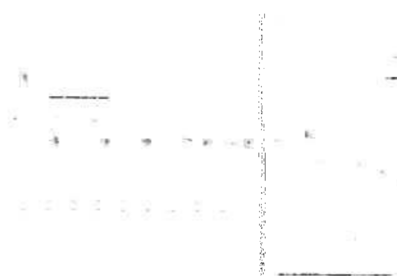


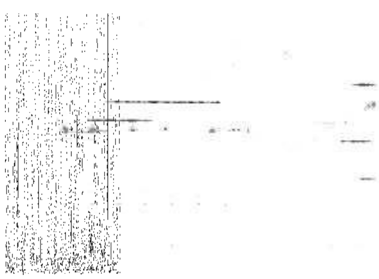












APPENDIX H

OU13 LUC INSPECTION CERTIFICATIONS, INTERVIEW FORMS, SITE INSPECTION FORM

INTERVIEW RECORD

Site Name: OU 13 Sites 8 and 24		**EPA ID No.:**	
Subject:		**Time: 1506**	**Date: 5/2/12**
Type: Telephone Ξ Visit Other **Location of Visit: NAS Pensacola**		Incoming Outgoing	

Contact Made By:

Name: Peggy Churchill	**Title:** Project Manager	**Organization:** Tetra Tech Inc.
Name: Amber Igoe	**Title:** Environmental Specialist II	**Organization:** Tetra Tech Inc.

Individual Contacted:

Name: Greg Campbell	**Title:** Environmental Engineer	**Organization:** NAVFAC

Telephone No: (850) 452-3131 ext 3007 **Fax No:** **E-Mail Address:** gregory.campbell@navy.mil	**Street Address:** 310 John Tower Road **City, State, Zip:** Pensacola FL, 32508

Summary Of Conversation

The overall impression of the project is that it is going well. Site operations have not affected the surrounding community and there has not been any reported community concerns. Local authorities have not received reports of vandalism, trespassing or any emergency responses occurring at the Site. The base is well informed of Site activity, progress and Land Use Control (LUC) inspections are conducted annually.

E

AMP NUR ENG cad

a w

6.

7.

8.

E

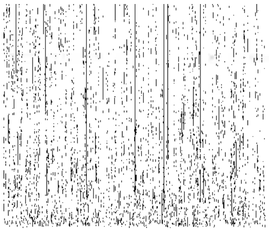
Amp NVR ENG cad

INTERVIEW REPORT

Contact Details

Individual Contacted

Summary of Conversation



M

F

Y not

TETRA TECH

APPENDIX I

OU18 LUC INSPECTION CERTIFICATIONS, INTERVIEW FORMS, SITE INSPECTION FORM

INTERVIEW RECORD

Site Name: OU 18 Site 43 Demolition Debris Disposal Area	**EPA ID No.:**	
Subject:	**Time: 1312**	**Date: 5/2/12**
Type: Telephone Ξ Visit Other **Location of Visit: NAS Pensacola**	Incoming Outgoing	

Contact Made By:

Name: Peggy Churchill	**Title:** Project Manager	**Organization:** Tetra Tech Inc.
Name: Amber Igoe	**Title:** Environmental Specialist II	**Organization:** Tetra Tech Inc.

Individual Contacted:

Name: Greg Campbell	**Title:** Environmental Engineer	**Organization:** NAVFAC
Telephone No: (850) 452-3131 ext 3007 **Fax No:** **E-Mail Address:** gregory.campbell@navy.mil	**Street Address:** 310 John Tower Road **City, State, Zip:** Pensacola FL, 32508	

Summary Of Conversation

The overall impression of the project is that is going fine. Site operations have not affected the surrounding community and there has not been any reported community concerns. Local authorities have not received reports of vandalism, trespassing or any emergency responses occurring at the Site. The site does have proper signage informing the community that the site is a Land Use Control (LUC) area and that access is restricted and digging is prohibited. There have been no reports of vandalism, trespassing or any emergency responses from local authorities. The base is well informed of Site activity, progress and LUC inspections are conducted annually.

UME O

Campbell M. N scott

Fi -

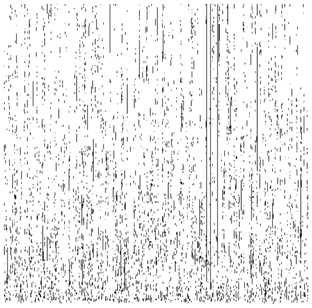
- R

M

6.

7.

8.



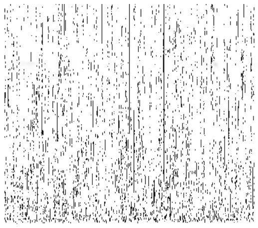
UME O

INTERVIEW RECORD

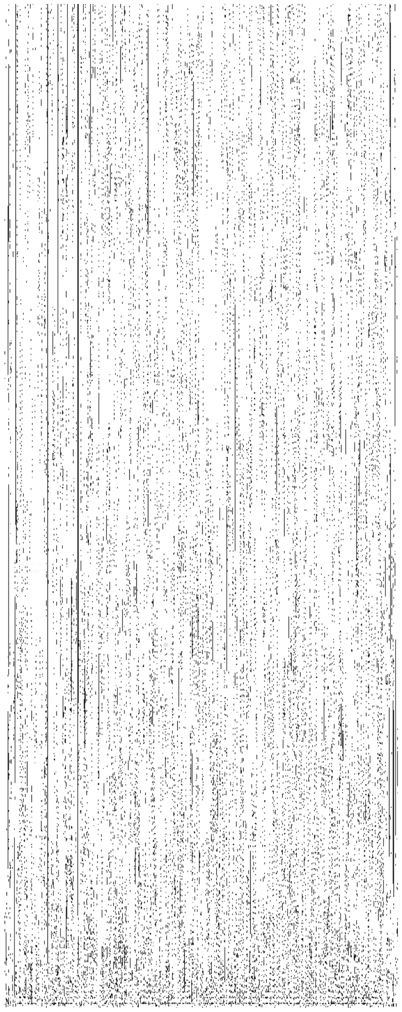
Summary Of Conversation

e n

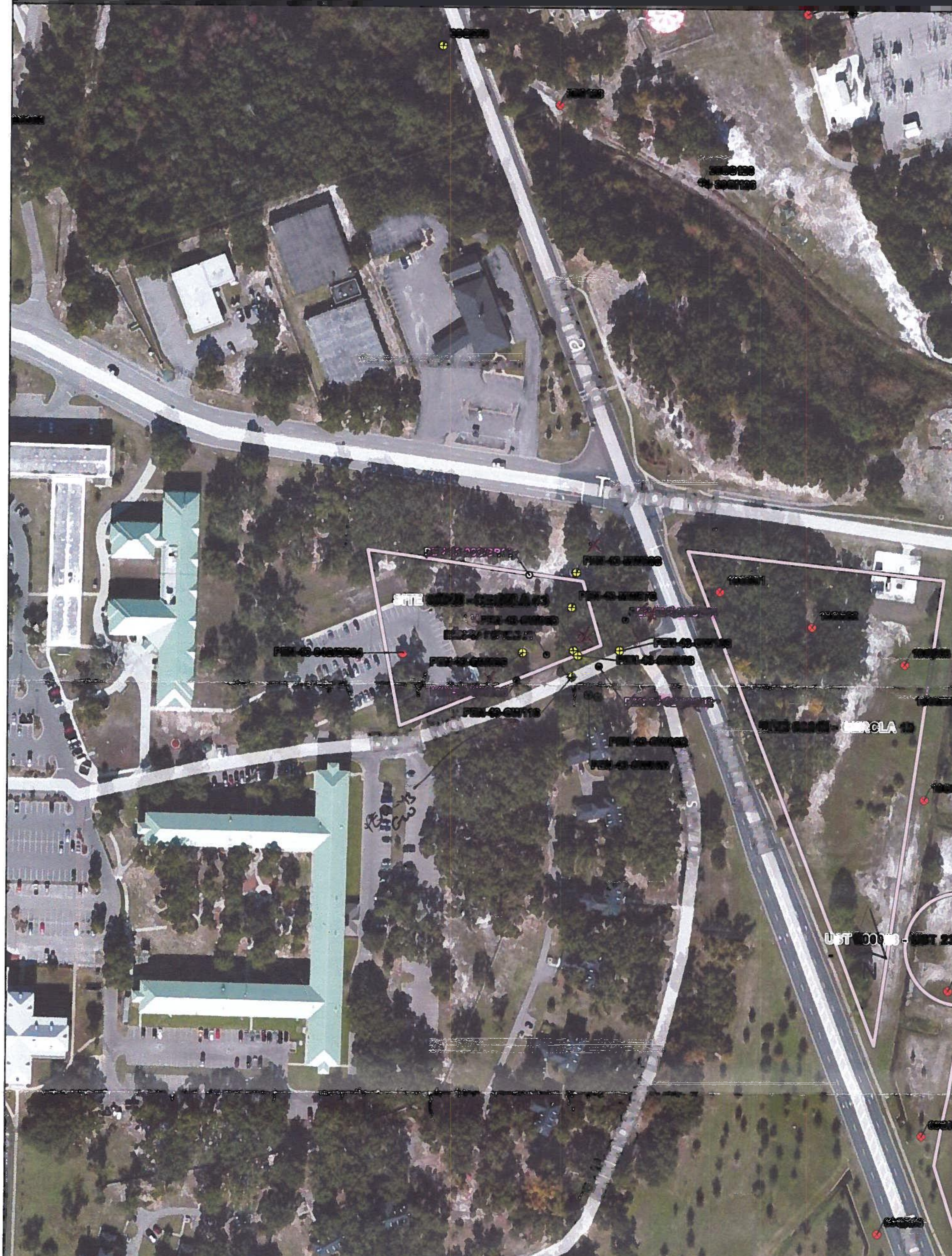
e



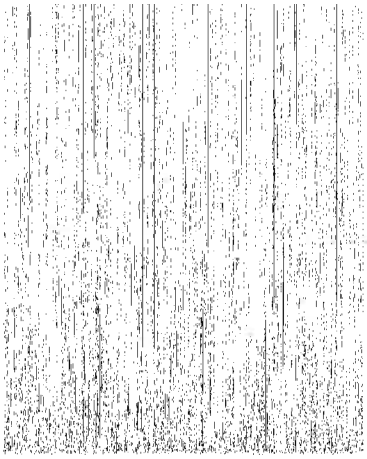
E



NAS PENSACOLA - 5 YEAR REVIEW MONITOR WELL INVENTORY



TETRA TE



gnat

APPENDIX J

WHITE PAPER - EVALUATING NO ACTION (NA) AND NO FURTHER ACTION (NFA) SITES FOR CHANGING STANDARDS DURING FIVE-YEAR REVIEWS PER THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) (JUNE 6, 2012)

Evaluating No Action (NA) and No Further Action (NFA) Sites for Changing Standards During Five-Year Reviews per the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
June 6, 2012

PURPOSE

This white paper has been prepared for internal Navy discussion purposes to clarify five-year review requirements for evaluating protectiveness of remedies based on changing regulations (e.g., new Federal and State maximum contaminant levels [MCLs] for arsenic) and toxicity data at sites that have been designated for NA or NFA. This issue was raised by the U.S. Environmental Protection Agency (EPA) Region 4 Remedial Project Manager (RPM) for Naval Air Station (NAS) Pensacola on April 11, 2012 during the scoping meeting for the current NAS Pensacola five-year review.

This paper provides a summary of the key issues, respective EPA and Navy positions, conclusions, and both general and NAS Pensacola specific recommendations for consideration and discussion by the Navy. Attachments to the White Paper include: Attachment A - EPA's position and interpretation of supporting information from the EPA Five-Year Review Guidance; Attachment B - a table that lists all sites at NAS Pensacola including Potential Sources of Contamination (PSCs) and respective NFA and Record of Decision (ROD) status; Attachment C - the Navy Five-Year Review Policy; and Attachment D - the EPA Five-Year Review Guidance.

ISSUES AND EPA REGION 4 RPM POSITION

The primary issue is documented in Attachment A, an email sent by the EPA RPM following the scoping meeting for the NAS Pensacola Five-Year review to clarify EPA's position and interpretation of supporting information from the EPA Five-Year Review Guidance, June 2001 (Attachment D). Both the Navy Five-Year Review Policy, June 2011 (Attachment C) and the EPA Five-Year Review Guidance indicate that a five-year review should only be conducted for a site if the remedy leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use (UU) and unrestricted exposure (UE), i.e., the remedy relies on restrictions on use of the land or other natural resources to be protective. However, as stated below, the EPA RPM's position is basically that sites with NFA RODs that met the UU/UE criteria at the time the ROD was signed must be reevaluated based on any new standards, e.g., MCLs, to see if the NA/NFA Determination remains protective, i.e., still meets the UU/UE criteria under the new standards, before eliminating the site from consideration in the five-year review. The EPA RPM's position is stated in the following excerpt from Attachment A:

> *"The Five-Year review guidance states that if a site is NFA because it meets the criteria of unlimited exposure and unlimited use (UU/UE) then it does not need to be evaluated in a Five-Year review. This assumes that it meets the UU/UE criteria. RODs should be evaluated to see if*

> *they meet this standard before being eliminated from consideration. The letters being circulated do not address whether the sites meet UU/UE.*
>
> *For example, a site may have been given a NFA determination based on the fact that the groundwater didn't exceed the arsenic standard of 50 ppm (sic) in groundwater. As we all know, this standard has changed to 10 and, therefore, this determination is no longer protective if the groundwater is above the current standard. It is an issue like this which would push the site back into the Five-Year review. RODs would give the first indicator of an issue but RI/FS and risk assessments should be reviewed, as well."*

Attachment A also includes several references from the EPA Five-Year Review Guidance cited by the EPA RPM in an effort to support the above rationale, although with what appears to be a broad interpretation of the guidance.

The EPA RPM's position essentially implies that the response complete status of sites with NA or NFA RODs meeting UU/UE criteria is always in question, subject to review under changing standards at each Five-Year review, and to potential reopening of the ROD.

A related secondary issue at NAS Pensacola involves potential sources of contamination (PSCs) previously recommended and approved for NFA (Attachment B). The EPA RPM has requested the historic groundwater data be compared with the new arsenic MCL at all sites and PSCs (On January 22, 2001, the EPA adopted a new MCL for arsenic in drinking water at 10 micrograms per liter [µg/L]. The EPA rule became effective on February 22, 2002 and became enforceable to water systems on January 23, 2006. In 2005, Florida lowered the MCL for arsenic in groundwater from 50 to 10 µg/L).

Similar to sites with NFA RODs meeting UU/UE criteria, EPA may also be questioning previous regulator decisions accepting recommendations at the Preliminary Assessment/Site Investigation (PA/SI) phase to eliminate some PSCs from further consideration. The EPA RPM has requested copies of the regulatory approval letters for PSCs recommended for NFA. The EPA RPM has not specifically suggested such PSCs require evaluation in the Five-Year review, but has requested the Navy to submit tables comparing the historic arsenic data to the new arsenic MCLs.

ISSUES ANALYSIS

Based on specific language in CERCLA, the National Contingency Plan (NCP), EPA Five-Year Review Guidance, and the Navy Five-Year Review Policy as detailed in the highlighted wording of related excerpts below, Five-Year reviews are not required for sites having NA or NFA RODs meeting the UU/UE criteria.

In addition, for the secondary issue described above regarding NA or NFA determinations made for PSCs during the PA/SI phase, Five Year Reviews are not required for these sites, since the requirement only applies to post-ROD remedial actions.

CERCLA:

CERCLA §121(c), as amended by SARA states:

"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each Five-Years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented."

NCP:

The NCP (40 Code of Federal Regulations [CFR] §300.430(f) (4) (ii)), states:

"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every Five-Years after the initiation of the selected remedial action."

EPA Five-Year Review Guidance: (see Attachment D for the complete guidance)

1.2 When are five-year reviews required or appropriate?

Five-year reviews should be conducted either to meet the statutory mandate under CERCLA §121(c) or as a matter of EPA policy. Consequently, five-year reviews are classified in this guidance as either "statutory" or "policy." The Five-Year Review requirement applies to all remedial actions selected under CERCLA §121. Regions may also conduct other five-year reviews at their discretion. You should consider a number of factors when determining whether to conduct a Five-Year review, as discussed in the following two sections (see Sections 1.2.1 and 1.2.2). In general, five-year reviews are required whenever a remedial action results in hazardous substances, pollutants, or contaminants remaining on site. Under the Agency's interpretation contained in the NCP, the requirement in CERCLA §121(c) is triggered when remaining on-site hazardous substances, pollutants, or contaminants are above levels that allow for "unlimited use and unrestricted exposure." See 40 CFR §300.430(f)(4)(ii).

"Unlimited use and unrestricted exposure" (UU/UE) means that the selected remedy will place no restrictions on the potential use of land or other natural resources. In general, if the selected remedy relies on restrictions of land and/or groundwater use by humans and/or ecological populations to be protective, then the use has been limited and a five-year review should be conducted. For example, if a site is cleaned up to an industrial-use level, and/or other types of uses are restricted (e.g., residential use), then, generally, UU/UE is not met. Exhibit 1-1, "Types of Actions Subject to Five-Year Reviews," provides examples of the types of remedial actions subject to statutory and policy reviews.

1.5.4 How is a site that has a no action or a no further action ROD handled?

Consistent with Section 1.2, Regions should conduct a five-year review for a remedy where a no action or no further action ROD leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. For example, as a matter of policy Regions should conduct a review for an NPL site with a no action ROD where a removal-only action leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure, or where groundwater monitoring or other types of monitoring of contamination above action levels is the only remedial action selected. However, no five-year review may be needed when monitoring is used only to verify absence of contamination.

Navy Five-Year Review Policy: (see Attachment C for the entire policy)

5. POLICY

a. A Five-Year Review shall be conducted at an Environmental Restoration (ER) site (Installation Restoration [IR] and Munitions Response [MR]) if the remedial action objectives (RAO) selected for a remedial action will result in any hazardous substances, pollutants, contaminants, or Munitions and Explosives of Concern (MEC) remaining at the site above levels that allow for UU/UE.

CONCLUSIONS -- APPARENT DIFFERENCES IN NAVY AND EPA POSITIONS

As stated above, the Navy's policy, consistent with CERCLA, the NCP and EPA Five Year Review Guidance, is that Five-Year reviews are not required for sites having NA or NFA RODs meeting the UU/UE criteria. Therefore, Five-Year review provisions requiring determination of protectiveness of remedial actions, including as a result of changing standards, are not applicable to such sites. In addition, no provisions could be found in the references that would specifically require the reevaluation of NA or NFA RODs meeting UU/UE criteria at the time the ROD was signed.

For sites where NA or NFA determinations were made during the PA/SI phase, Five Year Reviews are not required, since the requirement only applies to post-ROD remedial actions.

Furthermore, Tetra Tech is not aware of any other EPA Regions asking that Five Year Reviews be conducted for sites with NA or NFA RODs meeting UU/UE criteria. Tetra Tech is also not aware of any other EPA Regions asking that Five Year Reviews be conducted for sites where NA or NFA determinations were made during the PA/SI phase.

The EPA RPM's rationale, conversely, appears to be based on a broad interpretation of the EPA Five-Year Review Guidance applying Five-Year review protectiveness evaluations to sites that do not require Five-Year reviews based on clearly stated provisions listed in Section 1 of the EPA Guidance.

RECOMMENDATIONS – GENERAL

Maintain the status quo for determining sites requiring Five-Year reviews, which is consistent with CERCLA, the NCP, Navy Five-Year Review Policy, and EPA Five-Year Review Guidance.

- Sites with NA or NFA RODs that do not have contamination remaining at the site above levels that allow for unlimited use and unrestricted exposure (i.e., the selected remedy does not rely on restrictions on the potential use of land or other natural resources to be protective) should not be included in Five-Year reviews, and should not require further evaluation of changing standards to determine if they need to be pushed back into the Five-Year review.
- Sites with NA or NFA RODs that do have contamination remaining at the site above levels that allow for unlimited use and unrestricted exposure (i.e., the selected remedy relies on restrictions on the potential use of land or other natural resources to be protective) should be included in Five-Year reviews and evaluations performed in accordance with Navy Five-Year Review Policy and EPA Five-Year Review Guidance, including requirements to evaluate continued protectiveness based on changing standards.

RECOMMENDATIONS – SPECIFIC TO NAS PENSACOLA

- Review the RODs for sites with NA or NFA RODs to see if they indicate whether or not a Five-Year Review is required, and respond accordingly.
    - For example, Site 2, Waterfront Sediments, will require a Five-Year review because the NA ROD states that hazardous substances remain on site and that Five Year Reviews are required.
- PSC sites with NFA determinations at the PA/SI or earlier pre-ROD phase should not be included in the Five-Year review. Five-Year reviews only apply to post-ROD remedial actions.
    - Provide approval letters as requested by regulators to support prior regulatory concurrence with the NFA recommendations.
- The Navy should not perform comparisons of historical arsenic or other chemical data with new standards, e.g., MCLs, requested by the EPA RPM at sites with NA or NFA RODs meeting the UU/UE criteria or PA/SI sites with NA or NFA Determinations because the decision documents indicate that the CERCLA response is complete at these sites.
- Update the background study for arsenic and other constituents detected at NAS Pensacola. Historical data indicates arsenic concentrations in groundwater are generally low and likely the result of geochemical processes releasing naturally occurring arsenic from soil sediments. Arsenic was not associated with site operations at any site except perhaps the pesticide mixing area. Also, historical data exceedances of the new arsenic MCL may be due to earlier sampling methods that resulted in more turbid samples, and sampling in accordance with current Standard Operating Procedures would likely indicate fewer exceedances.

OTHER CONSIDERATIONS

The Federal Facilities Agreement (FFA) for NAS Pensacola lists the Five-Year Review Report as a primary document subject to regulatory review and comment and dispute resolution. The FFA also contains provisions for requesting modifications to primary documents based on "Significant New Information", which could possibly be construed as new or modified promulgated standards, e.g., new MCLs. Since the FFA will exist until all sites are delisted from the NPL, the EPA could potentially use the FFA for leverage in any negotiations related to the Five-Year Review. If the Navy chooses to negotiate and compromise on any EPA requests for Five-Year Review of sites in question, perhaps any Navy concessions could at least be limited to sites of greater potential risk or sites that had a higher potential for release of a particular contaminant.

ATTACHMENTS

ATTACHMENT A
EPA REGION 4 RPM EMAIL
NFA SITES AND CHANGING STANDARDS 04-11-12

From: Tim Woolheater [mailto:Woolheater.Tim@epamail.epa.gov]
Sent: Wednesday, April 11, 2012 5:27 PM
To: Whittemore, Patty CIV NAVFAC SE; Campbell, Gregory CIV NAVFAC SE, PWD Pensacola
Cc: David; Walker, Gerry; Tim Woolheater; Sam.Naik@CH2M.com; Caldwell, Brian; Allison Harris
Subject: NFA sites and changing standards

To address my action items and add a little clarification:

The 5 year review guidance states that if a site is NFA because it meets the criteria of unlimited exposure and unlimited use (UU/UE) then it does not need to be evaluated in a 5 year review. This assumes that it meets the UU/UE criteria. RODs should be evaluated to see if they meet this standard before being eliminated from consideration. The letters being circulated do not address whether the sites meet UU/UE.

For example, a site may have been given a NFA determination based on the fact that the groundwater didn't exceed the arsenic standard of 50 ppm in groundwater. As we all know, this standard has changed to 10 and, therefore, this determination is no longer protective if the groundwater is above the current standard. It is an issue like this which would push the site back into the 5 year review. RODs would give the first indicator of an issue but RI/FS and risk assessments should be reviewed, as well.

Here is some language from the guidance:

1.2 When are five-year reviews required or appropriate? ...The Agency interpreted this requirement further in the National Contingency Plan (NCP) (40 CFR §300.430(f)(4)(ii)) which states: If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

1.5.4 How is a site that has a no action or a no further action ROD handled? Consistent with Section 1.2, Regions should conduct a five-year review for a remedy where a no action or no further action ROD leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure.

3.5.1: Your review team should be familiar with appropriate site-specific data and information including the items listed below:
• Remedial action objectives and cleanup levels, as specified in the ROD and other decision documents; • Remedial action design and remedial action construction; • O&M status; • Implementation of institutional controls; • Changes that affect the validity of cleanup levels (e.g., standards identified as Applicable or Relevant and Appropriate Requirements (ARARs), “to be considereds” (TBCs), assumptions about contaminant characteristics and potential exposure); and • Data supporting the effectiveness of the remedy in meeting cleanup levels and remedial action objectives.

Exhibit 4-1: Three Questions Used to Determine Whether a Remedy is Protective
When you ask... you should consider whether...
4-2
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

- there are changes in standards identified as Applicable or Relevant and Appropriate Requirements (ARARs) in the ROD, newly promulgated standards, and/or changes in TBCs identified in the ROD, that could call into question the protectiveness of the remedy;

- there are changes in the toxicity factors for contaminants of concern.

Tim Woolheater
EPA-4SF-FFB, 61 Forsyth Street, Atlanta, GA 30303 404-562-8510, 404-414-3219 (cell), 404-562-8518 (fax) woolheater.tim@epamail.epa.gov

ATTACHMENT B

TABLE – NAS PENSACOLA SITES AND PSCS INCLUDING ROD AND NFA STATUS

Potential Source of Contamination and Site Status
Installation Restoration Project
NAS Pensacola
Pensacola, Florida

PSC No.	OU Group	SITE SWMU UST AOC PSC	Site Name	FFA Screening Site	ROD Date	NFA date	Regulatory Status	Last Decision Document	Comments
1	1	1	Sanitary Landfill	No	09/25/98	NA	Active remedy	Annual Monitoring Report	Monitor until groundwater concentrations are below standards; Optimization Study in 2005. Site wide groundwater MNA
2	3	2	Waterfront Sediments	No	09/30/05	9/30/05	ROD	No Action	ROD States " This remedy results in hazardous substances remaining onsites; therefore a 5-year review will be required as recommended in the NCP"
3		UST 18	Crash Crew Training Area	No	NA	NA	Transferred to Florida Petroleum Program		
4		4	Army Rubble Disposal Site	Yes	NA	09/30/97	No Action	Site Characterization Report	Site 4 Preliminary Site Characterization Report (7/31/97)
5		5	Borrow Pit	Yes	NA	10/04/95	No Action	Site Characterization Report	Site 5 Preliminary Site Characterization Report (7/7/95)
6		6	Fort Redoubt Rubble Disposal Area	Yes	NA	10/22/97	No Action	FDEP approval letter (10/22/97)	
7		7	Fire Fighting Training School	Yes	NA	11/09/00	No Action	Site Characterization Report	Site 7 Preliminary Site Characterization Report (01/17/97) Removal Action Completion Report (11/19/98)
8	13	8	Rifle Range Disposal	No	10/05/06	NA	Active remedy	Annual Monitoring Report	Conducted year 4 of 5 year LTM Plan. Final annual sampling event scheduled for October 2011.
9	6	9	Navy Yard Disposal Site	No	09/07/99	09/23/99	ROD	No Further Action	ROD states: " Because this remedy will not result in hazardous substances remaining onsite above health based levels, the five year review will not apply to this action.
10		10	Commodore's Pond	Yes	NA	11/09/00	No Action	Completion Report	Site 10 Preliminary Site Characterization Report (11/95) Removal Action Completion Report (11/19/98)
11	2	11	North Chevalier Disposal Area	No	09/29/08	NA	Active remedy	Remedial Design, RA UFP SAP & Groundwater to Surface Water Interface UFP SAP	Hotspot soil excavations for CERCLA contaminants will be conducted in unpaved areas during CY 2011 and LUCs will be implemented. LTM for groundwater contaminants.
12	2	12	Scrap Bins	Yes	09/29/08	NA	Active remedy	Remedial Design, RA UFP SAP & Groundwater to Surface Water Interface UFP SAP	Hotspot soil excavations for CERCLA contaminants will be conducted in unpaved areas during CY 2011 and LUCs will be implemented. LTM for groundwater contaminants.
13		13	Magazine Point Rubble Disposal Area	Yes	NA	08/14/96	No Action	Site Characterization Report	Site 13 Preliminary Site Characterization Report (9/95)
14		14	Dredge Spoil Fill area	Yes	NA	07/09/97	No Action	Site Characterization Report	Site 14 Preliminary Site Characterization Report (11/17/95)
15	4	15	Pesticide Rinsate Disposal Area	No	09/27/00	NA	Active remedy	Annual Monitoring Report	
16		16	Brush Disposal Area	Yes	NA	07/11/97	No Action	Site Characterization Report	Site 16 Preliminary Site Characterization Report (1/17/97)
17	14	17	Transformer Storage Yard	No	08/19/98	09/25/98	ROD	No Action	The ROD states " Because this remedy does not result in hazardous substances remaining onsite, a five-year review is not required."
18		18	PCB Spill at Substation A	Yes	NA	11/09/00	No Action	Site Characterization Report & Removal Action Completion Report	Site 18 Preliminary Site Characterization Report (7/31/96) Removal Action Completion Report (11/19/98)
19		UST 19	Fuel Farm Pipeline Leak	Yes	NA	NA	Transferred to Florida Petroleum Program		
20		UST 21	Pier Pipe Leak	Yes	NA	NA	Transferred to Florida Petroleum Program		
21		UST 22	Sludge at Fuel Tanks	Yes	NA	NA	Transferred to Florida Petroleum Program		
22		UST 26	Refueler Repair Shop	No	NA	NA	Transferred to Florida Petroleum Program		
23		UST 23	Chevalier Field Pipe Leak	Yes	NA	NA	Transferred to Florida Petroleum Program		
24	13	24	DDT Mixing Area	No	10/05/06	NA	Active remedy	Annual Monitoring Report	
25	2	25	Radium Spill Site	No	09/29/08	NA	Active remedy	Remedial Design, RA UFP SAP & Groundwater to Surface Water Interface UFP SAP	
26	2	26	Supply Department Outside Storage	No	09/29/08	NA	Active remedy	Remedial Design, RA UFP SAP & Groundwater to Surface Water Interface UFP SAP	
27	2	27	Radium Dial Shop Sewer	No	09/29/08	NA	Active remedy	Remedial Design, RA UFP SAP & Groundwater to Surface Water Interface UFP SAP	
28		28	Transformer Accident	Yes	NA	06/13/97	No Action	Site Characterization Report	Site 28 Preliminary Site Characterization Report (12/18/96)
29	6	29	Soil South of Building 34	NA	09/23/99	01/31/01	ROD	No Action	ROD states: " Because this remedy will not result in hazardous substances remaining onsite above health based levels, the five year review will not apply to this action.
30	2	30	Building 649 & 755	No	09/29/08	NA	Active remedy	Remedial Design, RA UFP SAP & Groundwater to Surface Water Interface UFP SAP	
31		31	Soil North of Building 648	No	NA	NA	No Action	Letter	Site 31 was incorporated into investigation and boundaries of Site 30 and included in OU 2
32	10	32	Industrial Sludge Drying Area	No	09/15/97	08/12/03	Transferred to RCRA Program	RA Completion Report	Remedial Action Completion Report (1/9/98)
33	10	33	Waste Water Treatment Plant	No	09/15/97	08/12/03	Transferred to RCRA Program	RA Completion Report	Remedial Action Completion Report (1/9/98)
34		34	Building 3557	Yes	NA	09/08/00	No Action	Letter (8/18/99)	

Potential Source of Contamination and Site Status
Installation Restoration Project
NAS Pensacola
Pensacola, Florida

PSC No.	OU Group	SITE SWMU UST AOC PSC	Site Name	FFA Screening Site	ROD Date	NFA date	Regulatory Status	Last Decision Document	Comments
35	10	35	Misc. IWTP sites	Yes	09/15/97	08/12/03	Transferred to RCRA Program	RA Completion Report	Remedial Action Completion Report (1/9/98)
36		36	Industrial Waste Sewer Line	Yes	NA	07/16/97	No Action	Site Characterization Report	Site 36 Preliminary Site Characterization Report (4/25/97)
37		UST 24	Sherman Field Fuel Farm	Yes	NA	NA	Transferred to Florida Petroleum Program		
Sites Added Post Federal Facilities Agreement									
	11	38	Facility Hazardous Waste Storage	No	10/05/06	NA		Draft Remedial Design	
	12	39	Oak Grove Campground	No	08/30/95	03/06/98	ROD	No Further Action & ESD	OU 12 Explanation of Significant Differences (9/22/97). The ROD states : "Because the remedial action selected will resulted in hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, the five year review after initiation of the selected remedial action will be necessary." The ESD states: "The selected remedy for Sit e39 was for No further Action with a review of the site within five years. The significant difference to the July 1995 ROD involves deleting the five-year review, which was included because risk assessment indicated the detected arsenic and aluminum in groundwater contributed to a potential for excess risk. Arsenic occurs naturally and the detected levels in groundwater (5 parts per billion [ppb]) are less than the federal maximum contaminant level and Florida primary drinking water standard (50 ppb). This change will provide cost savings while protecting human health and the environment. Aluminum occurs naturally and exceeded its federal secondary maximum contaminant levels and Florida secondary drinking water standards. The exceedances are limited to the upper portion of the shallow aquifer which would not be used for potable water in this area because of saltwater intrusion from Pensacola Bay."
	15	40	Bayou Grande Area	No	09/30/05	9/30/05	ROD	No Further Action	ROD says: "This remedy does not result in hazardous substances remaining onsite above health based levels, the
	16	41	Combined Wetlands	No	NA	NA		Draft Feasibility Study	
	17	42	Pensacola Bay Area	No	09/25/98	09/25/98	ROD	No Further Action	The ROD states: "No remedial action is necessary to ensure protection of human health and the environment. The selected remedy complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective."
	18	43	Demolition Debris Disposal Area	No	04/12/10	NA	Remedial Action	Final Remedial Design	Remedy of hotspot excavation, LUC and MNA to be implemented
	19	44	Former UST Site 3221	No	NA	NA	Informal Dispute	Draft Feasibility Study Work Plan (UFP SAP)	
	20	45	Building 603 Lead Site	No	NA	NA	Proposed Plan	Draft Proposed Plan	
	21	46	Former Building 72	No	NA	NA	Proposed Plan	Draft Proposed Plan	

CERCLA - Comprehensive Environmental Response, compensation and Liability Act
CY - Calendar Year
DDT - Dichlorodiphenyltrichoroethane
ESD - Explanation of Significant Differences
FDEP - Florida Department of Environmental Protection
IWTP - Industrial Wastewater Treatment Plant
LTM - Long Term Monitoring
LUC - Land Use Control
MNA - Monitored Natural Attenuation
NA - No Action
NFA - No Further Action
RA - Remedial Action
RCRA - Resource Conservation and Recovery Act
ROD - Record of Decision
UFP-SAP - Uniform Federal Policy Sampling and Analysis Plan
UST - Underground Storage Tank

ATTACHMENT C

NAVY FIVE-YEAR REVIEW POLICY, JUNE 2011

ATTACHMENT D

EPA FIVE-YEAR REVIEW GUIDANCE, JUNE 2001

United States
Environmental
Protection Agency

Office of Emergency
and Remedial
Response (5204G)

EPA 540-R-01-007
OSWER No. 9355.7-03B-P
June 2001

Superfund

Comprehensive Five-Year Review Guidance

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, D.C. 20460

URL: http://www.epa.gov/superfund/pubs.htm
Superfund Information 1-800-424-9346

[This page intentionally left blank.]

Preface

The U.S. Environmental Protection Agency (EPA) is issuing this "Comprehensive Five-Year Review Guidance" to assist EPA Headquarters (HQ), Regional staff, and support agencies responsible for conducting five-year reviews under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This guidance generally is intended to promote consistent implementation of the five-year review process.

Section 121 of CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires that remedial actions which result in any hazardous substances, pollutants, or contaminants remaining at the site be subject to a five-year review. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) further provides that remedial actions which result in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every five years to ensure protection of human health and the environment.

The Five-Year Review requirement applies to all remedial actions selected under CERCLA §121. Therefore, sites with CERCLA remedial actions may be subject to a five-year review. Consistent with Executive Order (EO) 12580, other Federal agencies are responsible for ensuring that five-year reviews are conducted at sites where five-year reviews are required or appropriate.

This guidance is designed and intended to:

- Provide an approach for conducting five-year reviews;
- Facilitate consistency across the ten EPA Regions;
- Clarify current policy; and
- Discuss roles and responsibilities of various entities in conducting or supporting five-year reviews.

This guidance supersedes the following directives on five-year reviews:

- Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-02 (May 23, 1991), *Structure and Components of Five-Year Reviews*;
- OSWER Directive 9355.7-02FS1 (August 1991), Factsheet: *Structure and Components of Five-Year Reviews;*

- OSWER Directive 9355.7-02A (July 26, 1994), *Supplemental Five-Year Review Guidance;* and

- OSWER Directive 9355.7-03A (December 21, 1995), *Second Supplemental Five-Year Review Guidance.*

In addition, this guidance updates and supersedes the text regarding five-year reviews in:

- OSWER 9200.1-23P (July 1999), *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*.

Questions or comments concerning this guidance should be directed to the appropriate EPA Headquarters Regional Center.

The policies and procedures established in this document are intended solely for the guidance of government personnel. They are not intended, and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. The Agency reserves the right to act at variance with these policies and procedures and to change them at any time without public notice.

This document provides guidance to EPA Regions concerning how the Agency intends to exercise its discretion in implementing one aspect of the CERCLA remedy selection process. The guidance is designed to implement national policy on these issues.

Some of the statutory provisions described in this document contain legally binding requirements. However, this document is not a substitute for those provisions or regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. Any decisions regarding a particular remedy selection decision will be made based on the statute and regulations, and EPA decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.

Table of Contents

Exhibits

Appendices

[This page intentionally left blank.]

List of Acronyms

AOC	Administrative Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
CA	Cooperative Agreement
CAG	Community Advisory Group
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
CIP	Community Involvement Plan
DOD	Department of Defense
DOE	Department of Energy
EO	Executive Order
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FCOR	Final Close Out Report
FFA	Federal Facility Agreement
FFRRO	Federal Facilities Restoration and Reuse Office
FR	Federal Register
HASP	Health and Safety Plan
IAG	Interagency Agreement
IC	Institutional Control
IRIS	Integrated Risk Information System
LOAEL	Lowest Observed Adverse Effect Level
MCLs	Maximum Contaminant Levels
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
O&M	Operation and Maintenance
OECA	Office of Enforcement and Compliance Assurance
OERR	Office of Emergency and Remedial Response
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PCOR	Preliminary Close Out Report
PRP	Potentially Responsible Party
RA	Remedial Action
RAGS	Risk Assessment Guidance for Superfund

RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act of 1986
SMOA	Superfund Memorandum of Agreement
SPIM	Superfund Program Implementation Manual
SSC	Superfund State Contract
TAG	Technical Assistance Grant
TBCs	To Be Considereds
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UU/UE	Unlimited Use/Unrestricted Exposure
WasteLan	The Regional database related to CERCLIS

1.0 OVERVIEW

This chapter covers the purpose of five-year reviews, when are reviews required or appropriate, discontinuation of five-year reviews, and triggering actions for five-year reviews. This chapter also discusses the application of the Five-Year Review policy to sites with multiple operable units (OUs), division of large complex sites, pre- and post-Superfund Amendments and Reauthorization Act of 1986 (SARA) sites, Records of Decision (RODs), and deleted or partially deleted sites. You will also find information on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial actions (RAs), CERCLA remedial actions at sites with Resource Conservation and Recovery Act (RCRA) response, and interim/early remedial actions. Finally, the chapter discusses how no action or no further action RODs, monitored natural attenuation (MNA), and institutional controls (ICs) impact five-year reviews.

1.1 What is the purpose of a five-year review?

The purpose of a five-year review is to evaluate the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment. Protectiveness is generally defined in the National Contingency Plan (NCP) by the risk range and the hazard index (HI). Evaluation of the remedy and the determination of protectiveness should be based on and sufficiently supported by data and observations.

1.2 When are five-year reviews required or appropriate?

Five-year reviews should be conducted either to meet the statutory mandate under CERCLA §121(c) or as a matter of EPA policy. Consequently, five-year reviews are classified in this guidance as either "statutory" or "policy." The Five-Year Review requirement applies to all remedial actions selected under CERCLA §121. Regions may also conduct other five-year reviews at their discretion.

You should consider a number of factors when determining whether to conduct a five-year review, as discussed in the following two sections (see Sections 1.2.1 and 1.2.2). In general, five-year reviews are required whenever a remedial action results in hazardous substances, pollutants, or contaminants remaining on site. Under the Agency's interpretation contained in the NCP, the requirement in CERCLA §121(c) is triggered when remaining on-site hazardous substances, pollutants, or contaminants are above levels that allow for "unlimited use and unrestricted exposure." See 40 CFR §300.430(f)(4)(ii).

CERCLA §121(c) states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation*

of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Agency interpreted this requirement further in the National Contingency Plan (NCP) (40 CFR §300.430(f)(4)(ii)) which states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

"Unlimited use and unrestricted exposure" (UU/UE) means that the selected remedy will place no restrictions on the potential use of land or other natural resources. In general, if the selected remedy relies on restrictions of land and/or groundwater use by humans and/or ecological populations to be protective, then the use has been limited and a five-year review should be conducted. For example, if a site is cleaned up to an industrial-use level, and/or other types of uses are restricted (*e.g.*, residential use), then, generally, UU/UE is not met. Exhibit 1-1, "Types of Actions Subject to Five-Year Reviews," provides examples of the types of remedial actions subject to statutory and policy reviews.

1.2.1 When is a statutory review required?

CERCLA requires five-year reviews if both of the following conditions are true:

- Upon completion of the remedial action, hazardous substances, pollutants, or contaminants will remain on site[1]; and
- The ROD for the site was signed on or after October 17, 1986 (the effective date of SARA[2]) and the remedial action was selected under CERCLA §121.

---

[1] The general response authority of CERCLA §104(c)(4) applies to both removal and remedial actions. 104(c)(4). Also see 40 CFR §300.430(f)(4)(ii).

[2] Generally, SARA became effective the date it was passed (October 17, 1986). See Pub. L. 99-499, Oct. 17, 1986, 100 Stat. 1672.

Exhibit 1-1: Types of Actions Subject to Five-Year Reviews

If the action/site is . . .	**then a review is . . .**	**and examples of actions or components of actions include . . .**
a ***post-SARA*** remedial action that, upon completion, will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure	required by ***statute***	– waste stabilization, fixation, or encapsulation on site – landfill cap or covers and slurry walls – institutional controls – sediment capping
a ***pre- or post-SARA*** remedial action that, upon completion, will not leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure, **but requires five or more years to complete**	conducted as a matter of EPA ***policy***, until cleanup levels are achieved, allowing unlimited use and unrestricted exposure	– long-term monitored natural attenuation – long-term groundwater pump and treatment – long-term bioremediation of groundwater or soil – other long-term remedies, such as soil washing and land farming – monitored natural recovery (sediments)
a ***pre-SARA*** remedial action that will leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure	conducted as a matter of EPA ***policy***	– waste stabilization, fixation, or encapsulation on site – landfill cap or covers and slurry walls – institutional controls
a ***removal*** **action that takes place at a site on** ***the NPL*** that leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure and **where no remedial action has or will take place**	conducted as a matter of EPA ***policy***	– excavation and treatment where hazardous substances, pollutants, or contaminants remain on site above levels that allow for unlimited use and unrestricted exposure

1.2.2 When is a policy review appropriate?

Five-year reviews generally should be conducted as a matter of policy for the following types of actions:

- A pre- or post-SARA remedial action that, upon completion, will not leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure, but requires five years or more to complete;

- A pre-SARA remedial action that leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure; or

- A removal-only site on the NPL where a removal action leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure and where no remedial action has or will take place.

1.2.3 When should five-year reviews be completed?

The first five-year review generally should be completed and signed by the EPA Region within five years of the initial trigger date (see Sections 1.3.1 and 1.3.2). As a matter of policy, you should complete subsequent statutory or policy five-year reviews no later than five years following the signature date of the previous Five-Year Review report. Five-year reviews may be conducted earlier or more frequently than every five years, if needed, to ensure the protection of human health and the environment.

1.2.4 When can five-year reviews be discontinued?

Five-year reviews may no longer be needed when no hazardous substances, pollutants, or contaminants remain on site above levels that allow for unlimited use and unrestricted exposure. The basis for this finding should be documented in your final Five-Year Review report. When you make this determination prior to the first five-year review, you should record it in a document subject to public comment, such as a Proposed Plan or a Notice of Intent to Delete. When notice of five-year review discontinuation is given in a document other than a Five-Year Review report, the Region should submit a memorandum, signed by the Regional Administrator or his/her designee, to Headquarters. The memorandum should provide the reason for not conducting five-year reviews and cite the document in which this decision was made and supported.

1.3 When does the five-year review period begin?

The initiation or trigger date that starts the five-year review period depends upon whether the review is categorized as statutory or policy. However, the review should be completed within 5 years of its trigger date regardless of its category. Lead agencies may choose to conduct a five-year review earlier, or more frequently, than every five years to ensure the protection of human health and the environment. A discussion of the first and subsequent triggers for both statutory and policy review is provided below.

1.3.1 What actions first trigger a statutory review?

In accordance with CERCLA §121 and the NCP, a statutory review is triggered by the initiation of the first remedial action that leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. In cases where there are multiple remedial actions, the earliest remedial action that leaves hazardous substances, pollutants, or contaminants on site should trigger the initial review, even if it is an interim remedial action.

For the purpose of a five-year review, a remedial action typically is initiated on the date of "actual RA on-site construction" or the "actual RA start" date for Federal facilities. The date of actual RA on-site construction generally corresponds to the date the contractor begins work at a site for the remedial action, typically the date of on-site mobilization. The definition of the "actual RA start" varies as outlined in the Superfund/Oil Program Implementation Manual (SPIM). For remedies where on-site mobilization may not occur, as a matter of policy, the date of the first monitoring event following ROD signature or the ROD signature itself should be used to trigger the five-year review period.

1.3.2 What actions first trigger a policy review?

A policy review initially should be triggered by the date that construction is completed at a site. The date of construction completion is generally the date of the Preliminary Close Out Report (PCOR) or the date of the Final Close Out Report (FCOR) for sites that do not have a PCOR. The PCOR or FCOR date also triggers the initial five-year review at NPL removal-only sites.

1.3.3 What are triggers for subsequent statutory and policy reviews?

After completion of the first statutory or policy five-year review, the trigger for subsequent reviews is the signature date of the previous Five-Year Review report. For reviews led by other Federal agencies, States, or Tribes, and where EPA has a concurrence role, the trigger for subsequent reviews corresponds to EPA's concurrence signature date of the preceding Five-Year Review report (see Sections 3.7.2 and 3.7.3).

1.4 How do five-year reviews apply to a site with multiple operable units?

Five-year reviews for sites with multiple OUs, as a matter of policy, should address all OUs and remedial actions that have been initiated at the time of the review, except for situations as described in Section 1.4.2. At the Regions' discretion, the five-year review may also include and consider areas of a site where no remedial action has been selected or initiated.

1.4.1 How is a multiple operable unit site categorized?

Five-year reviews for multiple OU sites can be categorized as either statutory or policy. As a matter of policy, a site is subject to a statutory review if any one of its initiated remedial actions is subject to a statutory review. A site is subject to a policy review if no initiated actions are subject to a statutory review and at least one action is subject to a policy review.

1.4.2 When is it appropriate to conduct a separate five-year review for different areas of a large and complex site?

At some large and complex sites, individual OUs, or groups of OUs, may have been treated as separate sites throughout the remedial process. Under these circumstances, Regions may continue to treat these areas separately and conduct individual five-year reviews for each area. Each five-year review should include the status and protectiveness determination of the five-year reviews conducted for the other areas of the entire site. Regions may choose to combine the separate reviews of different areas into a single five-year review prior to, or following, construction completion for the entire site. However, no area should be reviewed later than five years after its trigger date or previous review.

Actions within each area may trigger its respective statutory or policy review. However, in cases where site-wide construction completion will not be achieved for an extended period of time, the initial trigger date for a policy review should correspond to the date that physical construction is complete at the area under consideration. The Region should establish this date on a site-specific basis which should be based on the signature date of the Interim or Final RA Report.

1.4.3 How is a site with pre- and post-SARA RODs categorized?

At sites where there are both pre- and post-SARA RODs, the pre-SARA remedial actions are subject under this policy to post-SARA Five-Year Review procedures. For example, suppose a pre-SARA remedial action initially is subject to a policy review because hazardous substances, pollutants, or contaminants are permanently left on site above levels that allow for unrestricted use and unlimited exposure. If a post-SARA ROD is signed for that same site, a five-year review should be conducted, unless the post-SARA ROD selects a remedy that removes all on site hazardous substances, pollutants, or contaminants including the hazardous substances, pollutants, or contaminants left on site by the pre-SARA action. In such cases, the original five-year review schedule should be maintained as a matter of policy. If no schedule has been established, the post-SARA trigger should be utilized.

1.5 What are some other considerations for five-year reviews?

This section discusses other considerations (*i.e.*, deletions, RCRA responses, interim and early remedial actions, no action or no further action RODs, monitored natural attenuation, and institutional controls) that may affect the need for and conduct of five-year reviews.

1.5.1 Are five-year reviews required for a site that has been deleted or partially deleted from the NPL?

It is EPA's policy that the Five-Year Review requirement is independent of and unaffected by the deletion process.[3] Consistent with the NCP, a site can be deleted or partially deleted from the NPL once the deletion criteria have been satisfied. If a site has been deleted or is in the process of being deleted, your Five-Year Review report should address the status of any deletion action. Five-year reviews continue as needed after deletion.

1.5.2 Are five-year reviews required for a site with a RCRA response?

In 1996, EPA established a policy to defer some CERCLA cleanup activities to the RCRA program. The policy is outlined in the memorandum "Coordination Between RCRA Corrective Action and Closure and CERCLA Site Activities."[4] This policy allows site managers to defer cleanup activities for all or part of a site from CERCLA to RCRA (or vice versa). If a site is deferred to RCRA prior to being placed on the NPL, or is deleted from the NPL prior to the selection of the remedy and deferred to RCRA for corrective action, you do not need to conduct a five-year review.

In cases where full deferral is not appropriate, it is possible that both RCRA and CERCLA authorities will be used to address a site. When a RCRA action is included as a part of a CERCLA action, the RCRA action should be included in the five-year review as a matter of policy, if a five-year review is required or appropriate.

1.5.3 How is a site that has an interim or early remedial action handled?

Regions should conduct five-year reviews for interim or early actions selected under CERCLA §121 consistent with Section 1.2 of this guidance.[5] For instance, Regions should conduct a review if an alternate water supply is installed and hazardous substances, pollutants, or contaminants remain on site above levels that allow for unlimited use and unrestricted exposure. If a subsequent action reduces the hazardous substances, pollutants, or contaminants on site to

---

[3] In 1991, EPA clarified its policy on whether a site deleted from the NPL is subject to a five-year review. See "Notice of Policy Change," 56 FR 66601 (December 24, 1991). In appropriate circumstances, a site does not need to be kept on the NPL solely for the purposes of conducting five-year reviews (See 55 Fed Reg at p. 8699).

[4] The memorandum "Coordination Between RCRA Corrective Action and Closure and CERCLA Site Activities" was issued by Steven A. Herman, Assistant Administrator, Office of Enforcement and Compliance Assurance, and Elliott P. Laws, Assistant Administrator, OSWER (September 24, 1996).

[5] Interim and Early actions are defined in Chapter 8 in *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and other Remedy Selection Decision Documents*. EPA 540-R-98-031, OSWER 9200.1-23P (July 1999)

levels that allow unlimited use and unrestricted exposure, then reviews may be discontinued (see Section 1.2.4).

1.5.4 How is a site that has a no action or a no further action ROD handled?

Consistent with Section 1.2, Regions should conduct a five-year review for a remedy where a no action or no further action ROD leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. For example, as a matter of policy Regions should conduct a review for an NPL site with a no action ROD where a removal-only action leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure, or where groundwater monitoring or other types of monitoring of contamination above action levels is the only remedial action selected. However, no five-year review may be needed when monitoring is used only to verify absence of contamination.

1.5.5 How is a ROD that includes monitored natural attenuation handled?

CERCLA §121 remedies relying on monitored natural attenuation or natural attenuation may be subject to five-year reviews consistent with Section 1.2. If monitored natural attenuation is included in a no action or a no further action ROD, then that ROD is not considered to be no action or no further action and therefore, Regions may need to conduct a five-year review, consistent with this guidance.

1.5.6 How is a ROD that includes institutional controls handled?

Institutional controls may be part of remedies selected under CERCLA §121 and consistent with Section 1.2 of this guidance may be subject to five-year reviews.[6] If institutional controls are included in a no action or a no further action ROD, and protectiveness relies on the institutional control, then that ROD is not considered to be no action or no further action and therefore, Regions may need to conduct a five-year review.

---

[6] Regions should refer to OSWER 9355.0-74FS-P, dated September 2000, entitled *Institutional Controls: A Site Manager's Guide to identifying, evaluating and selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups* for further information on institutional controls and remedy selection.

2.0 ROLES AND RESPONSIBILITIES FOR EPA, STATES, TRIBES, AND OTHER FEDERAL AGENCIES

This chapter discusses the roles and responsibilities of U.S. Environmental Protection Agency (EPA), other Federal agencies, State agencies, and Tribes, in conducting five-year reviews. As a general matter, for remedies selected under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121, except at non-NPL Federal facility sites, EPA has the ultimate authority for determining whether a remedy subject to the Five-Year Review requirements in CERCLA §121(c) is protective. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) addresses, in general, the involvement of State agencies and Tribes in CERCLA actions in 40 CFR §300.515 and §300.520. Finally, CERCLA §120 and Executive Order (EO) 12580[7] address the responsibilities of Federal agencies in carrying out CERCLA cleanups.[8]

2.1 What are the roles of the lead and support agencies?

Under the NCP, the lead agency provides for the remedial project manager (RPM) "to plan and implement [the] response action;"[9] a response action would include conducting a five-year review. A support agency "furnish[es] necessary data to the lead agency, reviews response data and documents, and provides other assistance."[10] The NCP also encourages appropriate State and Tribal involvement for Fund-financed and Enforcement-lead remedial actions (see 40 CFR §300.515 and §300.520). Where the State or Tribe is the lead agency, the NCP provides that EPA concurrence is needed on remedy selection decisions (see 40 CFR §300.515(e) and §300.520).

The relative roles and responsibilities for lead and support agencies can vary significantly depending on ability, resources, and legal authorities. There are a number of documents that can be used to specify roles and responsibilities of lead and support agencies. Some of these are general in scope, while others are more narrow in scope and apply solely to a specific site. General instruments include Superfund Memoranda of Agreement (SMOAs), Cooperative Agreements (CAs), and Superfund State Contracts (SSCs). Normally, SMOAs are general, non-site-specific agreements that EPA uses to define roles and interactions in conducting a response action. EPA uses CAs to transfer Superfund monies to States or Tribes for response activities. SSCs are used to identify EPA and State or Tribal roles and responsibilities required under

---

[7] Executive Order No. 12580 of January 23, 1987, as amended on August 28, 1996.

[8] As discussed in section 2.4, State enforcement-lead cleanups are not subject to this guidance.

[9] See 40 CFR §300.5.

[10] Id.

CERCLA §104. Site-specific agreements include Consent Decrees, Administrative Orders on Consent, and Federal Facility Agreements (FFAs). If no SMOA, SSC, or CA is available, a letter of agreement should be written to define roles and responsibilities for the five-year review, consistent with the NCP (see 40 CFR §300.515). Wherever possible, the specific roles and responsibilities regarding the conduct of a five-year review should be detailed in a single document to avoid confusion and disputes at a later date.

2.1.1 What are the roles of the lead agency?

The lead agency conducts the five-year review, prepares the Five-Year Review report, and submits the report to the support agency for review and comment. The lead agency is also responsible for conducting community involvement activities and for ensuring that recommendations and follow-up actions identified during five-year reviews are completed. Generally, funding for five-year reviews is provided by EPA for Fund-financed sites, Potentially Responsible Parties (PRPs) for Enforcement-lead sites (through appropriate mechanisms), and by other Federal agencies or departments for Federal facility sites.

Where EPA is the lead agency pursuant to 40 CFR §300.515, the Region should submit a copy of its final Five-Year Review report to EPA Headquarters (HQ) within 10 days of signature, and provide copies to the support agency and site information repositories. Where the State or Tribe is the lead agency, pursuant to 40 CFR §300.515, the State should submit a copy of the final Five-Year Review report to the Region; once the Region has concurred, the Region should provide a copy to EPA HQ within 10 days of signature, to any other support agencies, and to site information repositories. Where another Federal agency or department is the lead agency, pursuant to CERCLA §120 and EO 12580, the Federal agency or department should submit a copy of the final Five-Year Review report to the Region; once the Region has concurred, the Region should provide a copy to HQ within 10 days of signature, to any other support agencies, and to site information repositories.

2.1.2 What are the roles of the support agency?

The role of the support agency is to participate in the review process, if requested, and review and comment on the Five-Year Review report. Where the State or Tribe is the lead agency for a response action (such as conducting a five-year review), the NCP provides that it must obtain EPA’s concurrence (see 40 CFR §300.515(e)).

The lead agency should give the support agency an adequate opportunity to participate in the five-year review process and to review and comment on the draft Five-Year Review report before it is finalized. When there is more than one support agency involved, time allowances for review and comment should be the same for all support agencies who choose to participate in the review process. The amount of time that a support agency will have to review the Five-Year Review report should be documented in the SMOA, SSC, CA, or other agreement documents, but should not be less than review times for other remedy decision documents (see 40 CFR §300.515(h)(3)). The goal should be to resolve any concerns of support agencies before drafting the final report. In any case, the support agency or agencies may provide written comments on the Five-Year Review report. Lead and support agencies should work together throughout the five-year review process to ensure that concerns are resolved in a timely manner, and to the extent practicable, prior to finalizing the Five-Year Review report.

2.2 Who conducts the review at a Fund-financed site?

At Fund-financed sites, the ultimate responsibility for the protectiveness determination rests with EPA. As described in Section 2.1, EPA may be the lead or support agency.

Regions may acquire the services of a contractor or establish agreements with other agencies (*e.g.*, the U.S. Army Corps of Engineers) to perform studies, conduct investigations, and/or develop draft Five-Year Review reports. In all cases, Regions should ensure the quality and completeness of review activities and the content of the final Five-Year Review report.

2.3 What if a site is an Enforcement-lead site?

At CERCLA Enforcement-lead sites, the ultimate responsibility for the quality and completeness of review activities and the content and protectiveness determinations of the Five-Year Review report rests with EPA. As described in Section 2.1, EPA may be the lead or support agency.

At sites in which EPA is the lead agency Regions may acquire the services of a contractor or establish agreements with other agencies (*e.g.*, the U.S. Army Corps of Engineers) to perform studies, conduct investigations, and/or develop draft Five-Year Review reports.

PRPs or PRP-hired contractors may perform certain support activities (*e.g.*, data collection, studies or analysis) according to provisions of an enforceable agreement.

2.4 What if site activities are led by a State or Tribe?

As described in Section 2.1, States and Tribes can be the lead agency in carrying out a five-year review. In those cases, States or Tribes should ensure the quality and completeness of review activities and the content of the final Five-Year Review report, prior to submitting the report to the Region for EPA's concurrence. When a State or Tribe provides EPA with a Five-Year Review report, EPA can choose to concur with the report and protectiveness statements or make its own protectiveness determinations.

Where a State or Tribe conducts a cleanup using its own legal authorities (*e.g.*, State enforcement action under a CERCLA-equivalent State law), the remedy is not selected pursuant to CERCLA §121 and is not subject to the Five-Year Review requirement.

Exhibit 2-1 provides an overview of the typical roles of different parties for each type of response action.

Exhibit 2-1: Typical Roles in the Five-Year Review Process*

If the response action is...	at...	under...	then conducting the review is the responsibility of...	with funding by...	and with the EPA Region...
Fund-financed	a site	CERCLA §121,and CERCLA §104	the lead agency; when the lead agency is a State or Tribe, EPA concurs;	Superfund	making or concurring with the protectiveness determination.
Enforcement-lead	a site	CERCLA §104 and §121, along with a Consent Decree or other enforcement document	the lead agency; when the lead agency is a State or Tribe, EPA concurs. (PRPs may be allowed to provide certain support for five-year reviews);	PRPs	making or concurring with the protectiveness determination.
Other Federal agency or department (*e.g.*, led by Department of Defense, Department of Energy or Department of the Interior)	a Federal facility NPL site	CERCLA §104, §120 and §121, Executive Order 12580, and a Federal Facility Agreement	the respective Federal agency or department	the respective Federal agency or department	making or concurring with the protectiveness determination.
Other Federal agency	a Federal facility non-NPL site	CERCLA §104 and §121, and Executive Order 12580	the respective Federal agency or department	the respective Federal agency or department	commenting on the protectiveness determination (if requested).

Note: * The scenarios presented in the exhibit are not all inclusive. Regions should determine the respective roles in the five-year review process when other circumstances exist. EPA does not have a role in five-year reviews at non-NPL Federal facility sites; however, EPA Regions may comment or be asked to comment on a site-specific basis.

2.5 What if site activities are led by another Federal agency or department?

CERCLA §104, §120, and §121 identify functions and responsibilities vested in the President for undertaking response efforts and coordinating all other efforts at the scene of a release on or from Federally-owned property (or vessels). The President, in EO 12580, delegates some of these responsibilities to the respective Federal agencies and departments for Federally-owned or Federally-operated facilities over which these lead agencies have jurisdiction, custody, or control.

Therefore, at sites where activities are led by another Federal agency or department, the Federal agency or department has responsibilities for selecting remedies and implementing the remedial actions, and for conducting all required five-year reviews. The Federal agency or department is responsible for planning, coordinating, funding, and conducting five-year reviews and for making protectiveness determinations upon conclusion of each five-year review. Federal agencies or departments are encouraged to have EPA, States, and Tribes participate and comment throughout the five-year review process, as appropriate. Federal agencies or departments are also responsible for initiating resolutions to issues and following up on all recommendations that result from these five-year reviews. Federal agencies or departments may not adopt or utilize guidelines that are inconsistent with EPA's Five-Year Review guidance or certain other EPA guidance, as specified in CERCLA §120(a)(2).

- ***Federal facility sites that are listed on the NPL*** **–** EO 12580 paragraphs 2(d) and (g) delegate remedial responsibilities to the Department of Defense (DOD) and the Department of Energy (DOE), and to EPA, respectively. In addition, at all Federal facility NPL sites, CERCLA §120 requires Federal agencies or departments to perform remedial investigation and feasability studies (RI/FS) (see CERCLA §120(e)(1)), to enter into Inter-Agency Agreements (IAGs) (frequently called Federal Facility Agreements), and to initiate remedial actions, subject to EPA concurrence. Therefore, five-year reviews are conducted by the Federal agency or department that has jurisdiction, custody, or control, but EPA retains final authority over whether the five-year reviews adequately address the protectiveness of remedies. EPA will either concur with the final Federal agency or department protectiveness determination, or EPA may provide independent findings. Disputes which arise related to protectiveness determinations or independent findings by EPA may be resolved on a site-specific basis through formal dispute resolution procedures, typically established in FFAs. Exhibits 2-2 and 2-3 and Sections 2.5.1 and 2.5.2 discuss Federal facility NPL sites and FFAs in more detail.

- ***Non-NPL Federal facilities*** **–** EO 12580, paragraphs 2(d) and (e), give remedial responsibilities, and therefore five-year review responsibilities, to the Federal agency or department having jurisdiction, custody, or control. EPA may also be asked to comment, to the extent practical, on five-year reviews or protectiveness determinations at non-NPL Federal facilities. Section 2.5.3 discusses non-NPL Federal facilities in more detail.

Exhibit 2-2 below provides an overview of relevant EO 12580 sections and their applicability.

Exhibit 2-2: Federal Responsibilities Under Executive Order 12580

In EO 12580 section(s)…	the President delegates to…	certain remedial functions and responsibilities in CERCLA section(s)…		and those remedial functions and responsibilities at Federal facilities generally pertaining to…
2(b)	***EPA*** (in consultation with the National Response Team)	121(f)(1)		promulgation of regulations assuring substantial and meaningful State involvement (in initiation, development, and selection of remedial actions to be undertaken in the State).
2(d)	***DOD, DOE,*** (subject to the requirements described in CERCLA §120)	104(a), 104(b), 104(c)(4),	and 121	selecting and taking NPL and non-NPL[(1) (2)] remedial actions, which includes both conducting five-year reviews and making protectiveness determinations (with EPA concurrence at NPL sites).
2(e)	***Federal Departments/ Agencies*** (for non-NPL Federal facility sites.)	104(a), 104(b), 104(c)(4),	and 121	selecting and taking non-NPL remedial actions, which includes both conducting five-year reviews and making protectiveness determinations.
2(g)	***EPA*** (subject to the above delegations)	104(a), 104(b), 104(c)(4),	and 121	selecting and taking NPL remedial actions, which includes conducting five-year reviews and making protectiveness determinations at Fund-lead and Enforcement-lead NPL sites.

Note: (1) EPA does not have a role in five-year reviews at non-NPL Federal facility sites; however, EPA Regions may be asked to comment on a site-specific basis.

(2) In addition to the EO 12580 delegation of remedy selection and remedial action responsibilities to all Federal agencies and departments for non-NPL Federal facility sites, CERCLA §120(e) establishes remedy selection and remedial action responsibilities for Federal agencies and departments for all Federal facility NPL sites, as well. For example, CERCLA §120(e)(2) requires Federal agencies and departments to enter into NPL IAGs (frequently called FFAs) with EPA (States may participate.) CERCLA §120(e)(4) requires FFAs to address selection of remedies and completion of remedial actions at Federal facility NPL sites. FFAs, where applicable, should specify the procedures to be followed with respect to conducting five-year reviews at Federal facility NPL sites.

The following subsections detail responsibilities for conducting five-year reviews at sites led by other Federal departments and agencies.

2.5.1 What is the purpose of FFAs at other Federal agency NPL sites?

CERCLA §120(e)(2) requires that EPA sign an IAG (frequently called an FFA) with responsible Federal agencies or departments to detail respective roles and responsibilities for remedial actions at NPL sites. CERCLA §120(e)(1) requires Federal agencies or departments to conduct remedial investigations in consultation with EPA and appropriate State authorities at Federal facility NPL sites. Most Federal facility NPL sites will have site-specific roles and responsibilities specified in the FFA. CERCLA §120(e)(4) requires FFAs to include selection of remedies, completion of remedial actions, and arrangements for long-term operation and maintenance of the facility. Therefore, the procedures for conducting five-year reviews and making protectiveness determinations fall within the scope of FFAs. FFAs should specify in detail the procedures governing five-year reviews at Federal facility NPL sites.

OSWER Directive 9320.0-75 (November 29, 1996), “Federal Facilities Streamlined Oversight Directive” reiterates EPA’s responsibility for oversight of remedial activities at Federal facility NPL sites. States and Tribes, as regulators, may also have an oversight role, defined in the FFA, at a facility. Exhibit 2-3 describes the topics to be addressed in an FFA.

Exhibit 2-3: Federal Facility Agreements and Five-Year Reviews

CERCLA § 120(e)(2) requires that the relevant Federal agency or department must enter into an FFA (IAG in the statute) with EPA within six months after EPA’s review of the Remedial Investigation/Feasibility Study (RI/FS) is completed. States may be signatories to the FFA and under CERCLA §120 (f) must be included in the decision-making process at Federal facility NPL sites. Whenever a Federal facility is located on Tribal lands, the appropriate Tribal government should be involved.

CERCLA §120(e)(4), in the case of schedules, requires that the EPA/DOD and EPA/DOE Model FFA contain procedures for the submission and review of documents, schedules of cleanup activities, and provisions for dispute resolution. Regions should examine FFAs with respect to the performance of five-year reviews to clarify:

- Roles, responsibilities, and milestones;
- Arrangements for long-term operation and maintenance of the facility; and
- Opportunities for public involvement.

For Federal facilities only, EPA considers Five-Year Review reports to be stand-alone primary documents or part of another related primary document that should have an enforceable schedule within the framework of the FFA. Where EPA enters into an FFA, the agreement should include all site-specific Five-Year Review requirements, such as provisions for reviews, public participation, and addressing or resolving issues.

Where the roles and responsibilities for conducting five-year reviews and making protectiveness determinations are not specified in an FFA (for example, the FFA may not have been signed, or it may be silent or unclear with respect to five-year reviews), then the parties should rely on this guidance for fulfilling EPA’s obligations under CERCLA §120 and §121, including making protectiveness determinations. Five-year review requirements should be identified early in the FFA process, so that the parties to the Agreement have clearly defined roles and responsibilities for implementing CERCLA §121(c) with respect to five-year reviews. However, consistent with CERCLA §120(g), FFAs cannot re-delegate EPA's final authority over whether the five-year reviews adequately address the protectiveness of remedies.

2.5.2 What is EPA's role at NPL sites under the jurisdiction of another Federal agency or department?

CERCLA §120 and EO 12580 provide the basis for EPA's oversight role at other Federal agency NPL sites. This role includes the following:

- Assisting in the determination of cleanup remedies or potentially selecting the remedies, in consultation with the lead agency and appropriate State authorities, beginning at the commencement of remedial investigations and feasibility studies;
- Ensuring that Federal agencies or departments appropriately consider all relevant guidance and policies that EPA determines are appropriate;
- Ensuring compliance with signed FFAs; and
- Determining that decisions protect human health and the environment and that such decisions are adequately supported in the Five-Year Review report (whether as a stand-alone primary document or part of a related primary document).

EPA is not responsible for conducting five-year reviews at Federal facility NPL sites. However, EPA's final remedy selection authority at Federal facility NPL sites requires that EPA retain final authority to make protectiveness determinations. Accordingly, EPA will either concur with any protectiveness determinations to ensure protection of human health and the environment, consistent with EPA's statutory and regulatory authorities or EPA may provide independent findings. EPA Regions should review Federal facility NPL Five-Year Review reports (whether as a stand-alone primary document or part of a related primary document) and protectiveness determinations for consistency with this guidance and adequacy of the supporting basis, and should participate or comment throughout the five-year review process, as appropriate.

2.5.3 What is EPA's role at a non-NPL site under the jurisdiction of another Federal agency or department?

EO 12580 paragraphs 2(d) and (e)(1) delegates the authority in CERCLA §104 and §121 to the Federal agencies or departments for selecting and conducting remedial actions addressing releases or threatened releases at sites that are not on the NPL. Consistent with CERCLA §121 and this guidance, Federal agencies or departments should conduct five-year reviews for all CERCLA non-NPL remedial actions that require a review (discussed in Section 1.2.1 of this guidance). It is EPA's expectation that Federal agencies or departments will also conduct five-year reviews as a matter of policy at sites that would be subject to policy reviews if they were on the NPL (see Section 1.2.2). EPA does not have a statutorily defined role in five-year reviews at non-NPL Federal facility sites. However, where EPA has had active and substantial involvement at a non-NPL Federal facility, or where agencies, States, Tribes, or citizens seek EPA comment on five-year reviews conducted at a non-NPL Federal facility, EPA may, to the extent practicable on a site-specific basis, comment on five-year reviews and protectiveness determinations made by other Federal agencies or departments at non-NPL Federal facilities, and/or provide independent findings, where applicable.

2.5.4 What are States' roles at non-NPL sites under the jurisdiction of a Federal agency or department?

Consistent with CERCLA §120(a)(4), at non-NPL Federal facilities sites, States generally have remedial oversight responsibilities and should be provided with adequate opportunity to participate in the five-year review process and to review the draft Five-Year Review document before it is finalized.

2.5.5 What happens when Federal agencies or departments transfer real property?

In instances of Federal-to-Federal transfer of jurisdiction, custody, or control of real property, the Federal agency or department having initiated CERCLA remedial actions generally should conduct any required or appropriate five-year reviews. Alternatively, the lead agency may assure that reviews are conducted by entering into reliable site-specific agreements with the Federal agency or department gaining control of the property, where those arrangements remain consistent with CERCLA and EO 12580. In instances of deed transfer of Federal property to third parties, the Federal agency or department having initiated CERCLA remedial actions generally should conduct any required or appropriate five-year reviews, unless other reliable site-specific procedures are arranged with the transferee (or others), and those arrangements remain consistent with CERCLA and EO 12580. Generally, however, the ultimate responsibility for conducting five-year reviews should remain with the Federal agency or department that initiated the CERCLA remedial actions.

[This page intentionally left blank.]

3.0 COMPONENTS OF THE FIVE-YEAR REVIEW PROCESS

This chapter discusses components of the five-year review process, including notifying potentially interested parties, developing a review schedule, establishing a review team, involving the community, and signing and submitting the Five-Year Review report. Data and other site-specific information that form the foundation for the technical assessment of the remedy at the time of the five-year review are discussed in this chapter, including data and document review, site interview, site inspection, and components of a Five-Year Review report.

3.1 Who is notified when planning the five-year review?

In the initial planning stages of the five-year review, all potentially interested parties should be notified that the five-year review will be conducted. This notification may include States and/or Tribes, appropriate representatives of the community, local officials, Federal and/or State Trustees for Natural Resources (Trustees)[11], appropriate EPA offices, and the Community Involvement Coordinator (CIC) for the site. Potentially responsible parties should be notified for Enforcement-lead sites.

3.2 How should I develop a review schedule?

You should develop a review schedule to meet the appropriate five-year review date of completion. The review schedule should allow sufficient time for each component of the five-year review process, including document review, site inspection, interviews, the assessment of the protectiveness of the remedy (see Chapter 4), and report development and final submission. You should incorporate into the five-year review schedule appropriate time for internal and inter-agency review and comment periods, community involvement activities, if needed, and finalizing the report with all required signatures.

3.3 How should I establish a review team?

You should determine the appropriate level of assistance and team structure. For some reviews, the project manager may be the only member of the team, consulting with technical experts as necessary. For other reviews, a multi-disciplinary team may be needed to adequately review the protectiveness of the remedy. Once team members are identified their roles should be clearly defined. Communication among team members, agencies, and organizations is critical to ensure that all parties remain informed throughout the entire five-year review process.

---

[11] OSWER Directive 9200.4-22A *CERCLA Coordination with Natural Resource Trustees*, dated July 31, 1997.

Exhibit 3-1 below provides examples of potential team members for a five-year review.

Exhibit 3-1: Potential Members of the Five-Year Review Team

- Project Manager (EPA, State, Tribal, DOD, DOI)
- Regional Biological Technical Assistance Groups (BTAGs)
- Federal and State Natural Resource Trustees
- Community Involvement Coordinator (CIC)
- State and/or local regulatory agency representatives
- Tribal representatives
- TAG representatives and/or community representatives
- Other Federal agency representatives (*e.g.*, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Agency for Toxic Substances and Disease Registry, U.S. Geological Survey, National Oceanic and Atmospheric Administration)
- Technical Experts
  - Construction representative
  - Engineers (*e.g.*, civil, geo-technical, structural, chemical, process)
  - Hydrogeologist
  - Chemist
  - Risk assessor
  - Biologist
  - Ecologist/ecological risk assessor
  - Attorney/legal advisor
  - Environmental regulatory specialist

3.4 How should I involve the community?

You should begin working with the site's CIC during the initial planning stages of your five-year review to determine the appropriate level of community involvement. At a minimum, your community involvement activities during the five-year review should include notifying the community that the five-year review will be conducted, notifying the community that the five-year review has been completed, and providing the results of the review to the local site repository (see Exhibit 3-2).

Together with the CIC, you should consider conducting additional community involvement activities at high profile sites, those with significant public interest, and any other sites for which the Region determines a need for additional community involvement activities. This may include notifying local public officials, including the primary local health agency, and the leadership of any relevant neighborhood and civic groups. (For ideas on notifying the public see *Publishing Effective Public Notices*, which is part of the CIC Toolkit (Web address: http://www.epa.gov/superfund/action/community/index.htm).)

In addition to this notification, you may also wish to interview several community members, at least some of whom live or work near the site, to get their views about current site conditions, problems, or related concerns. If there was or is a Community Advisory Group or a

Technical Assistance Grant related to the site, representatives of these groups should be briefed at the outset of the five-year review process, and, if requested, at other appropriate points. You may also want to consider appropriate ways, such as public meetings or an opportunity for submitting written comments, to get broader public involvement. For further information on community involvement during the five-year review process, see Appendix A, "Community Involvement."

Exhibit 3-2: Notification Requirements for Five-Year Reviews

At the beginning: Your notice to the community that a five-year review will be conducted should identify:

- The site name, its location and web address (if available);
- The lead agency conducting the review;
- A brief description of the selected remedy;
- A summary of contamination addressed by the selected remedy;
- How the community can contribute during the review process;
- A contact name and telephone number for further information; and
- The scheduled completion date of the five-year review.

At the end: Your notice to the community that a five-year review has been completed should include:

- The site name, its location and web address (if available);
- The lead agency conducting the review;
- A brief description of the selected remedy;
- A summary of contamination addressed by the selected remedy as provided in the initial notice;
- A brief summary of the results of the five-year review;
- The protectiveness statement(s);
- A brief summary of data and information that provided the basis for determining protectiveness, issues, recommendations, and follow-up actions directly related to the protectiveness of the remedy;
- Location(s) where a copy of the five-year review can be obtained or viewed (including site repositories);
- A contact name and telephone number where community members can obtain more information or ask questions about the results; and
- The date of the next five-year review or a statement and supporting rationale that five-year reviews will no longer be required.

3.5 What data do I need to evaluate the remedy?

Data and other pertinent site specific information that you should review include sampling and monitoring plans and results from monitoring activities, operation and maintenance (O&M) reports or other documentation of remedy performance, including previous Five-Year Review reports. These are the primary bases of the technical analyses and subsequent protectiveness determination(s). The type and quality of data are essential to your five-year review and its findings and conclusions. You may collect these types of data through a variety of means, including document review, interviews, and a site inspection. You also may need to conduct supplemental sampling or collect other data.

3.5.1 How are documents reviewed?

A review of documents is one of the first steps in the five-year review process. You are responsible for gathering all relevant documents, data, and other information in support of the five-year review. Generally, for an initial five-year review, this may require you to evaluate record keeping and the location of pertinent data and information. In cases where records are difficult to obtain, you should establish appropriate record keeping procedures to minimize future efforts needed to gather all necessary documents for subsequent five-year reviews.

Documents should be reviewed to obtain relevant information and data concerning a response action from which to base an assessment of its performance. The scope of the review is dependent on the complexity of the remedy(s) and the stage of remedy construction. You may need to review various documents to obtain the necessary information, including those for remedy decisions (*e.g.*, Records of Decision (RODs), Explanation of Significant Differences (ESDs)), enforcement (*e.g.*, Consent Decrees (CDs), Administrative Orders on Consent (AOCs)), site investigations (*e.g.*, remedial investigation/feasibility study (RI/FS)), design (*e.g.*, remedial design (RD)) and construction (*e.g.*, Preliminary Closeout Reports (PCOR), remedial action (RA) reports), and remedy performance and post-closure. (See Appendix B, "Document Review," for a more complete discussion of document review for the five-year review).

Your review team should be familiar with appropriate site-specific data and information including the items listed below:

- Remedial action objectives and cleanup levels, as specified in the ROD and other decision documents;
- Remedial action design and remedial action construction;
- O&M status;
- Implementation of institutional controls;
- Changes that affect the validity of cleanup levels (*e.g.*, standards identified as Applicable or Relevant and Appropriate Requirements (ARARs), "to be considereds" (TBCs), assumptions about contaminant characteristics and potential exposure); and
- Data supporting the effectiveness of the remedy in meeting cleanup levels and remedial action objectives.

3.5.2 How should I conduct interviews?

Interviews should be conducted, if necessary, to provide additional information about a site's status. The scope of interviews should be tailored to the remedy evaluation on a site-specific basis. Those interviewed may include the site manager; site personnel; Federal, State, and Tribal regulatory authorities; local officials; community action groups or associations;

residents and businesses located near the site; and other pertinent organizations or individuals. At an Enforcement-lead site, the lead agency should conduct the interviews. A Potentially Responsible Party (PRP) generally should not conduct interviews because there is a potential for a conflict of interest (see Appendix C, "Five-Year Review Interviews," for additional information). For Federal facility sites, a State and/or EPA representative may wish to be present at and/or participate in conducting interviews.

3.5.3 How should I conduct site inspections?

Your five-year review should include a recent site inspection. For purposes of conducting site inspections for five-year reviews, "recent" generally means no more than nine months from the expected signature date of the review. The review should be performed by objective parties without bias or preconceived views or conclusions about the remedy and conditions at the site. Site inspections are conducted to provide information about a site's status and to visually confirm and document the conditions of the remedy, the site, and the surrounding area.

At an Enforcement-lead site, the lead agency should conduct the site inspection. A PRP generally should not conduct the site inspection because of the potential for a conflict of interest. At Federal facility sites, a State and/or EPA representative may wish to be present and/or participate in conducting site inspections.

Appendix D, "Five-Year Review Site Inspection Checklist," may serve as your guide for planning and documenting a site inspection for containment, groundwater, and surface water remedies. Using this checklist should aid you in the planning and documentation of the site inspection. Therefore, you may adapt this checklist for other types of remedies or use other site inspection tools and checklists that have been developed by others for this purpose. You can find other checklists by accessing the web site: http://www.frtr.gov/optimization/general/ and clicking on " USACE Remediation System Evaluation Checklists."

3.6 What should I include in Five-Year Review reports?

In your Five-Year Review report, you should present the findings and conclusions of the review, including recommendations, follow-up actions to issues, and protectiveness determination(s). The report should also contain the data and information necessary to support all findings and conclusions.

Where your review only addresses a portion of a site, the report should provide a summary of the status of other operable units (OUs) and/or the remainder of the site. Similarly, for sites where you conduct a separate five-year review for different areas of a large or complex site (see Section 1.4.2), you should provide a summary of the status of the other areas of the site in your Five-Year Review report. Additionally, if you receive written comments on the Five-Year Review report from support agencies and/or the community (*e.g.,* States, Tribes, other

Federal agencies or departments, local governments, citizens, PRPs, other interested parties), you should attach a copy of these comments to the report.

A suggested "Five-Year Review Report Template" and "A Sample Five-Year Review Report" are provided in Appendices E and F, respectively. Exhibit 3-3 summarizes the recommended contents of a Five-Year Review report.

Exhibit 3-3: Contents of a Five-Year Review Report

The following report sections...	should include these topics when appropriate:
I. Introduction	– the purpose of the review – who conducted the review – when the review was initiated and completed – whether it is the first review or a subsequent review at the site – status of other five-year reviews, OUs, and/or areas of the entire site
II. Site Chronology	– dates of major events (such as the initial discovery of contamination, NPL listing, decision and enforcement documents, start and completion of remedial and removal actions, construction completion, and prior five-year reviews)
III. Background	– physical characteristics – land and resource use – history of contamination – initial response – summary of basis for taking action
IV. Remedial Actions	– remedy selection – remedy implementation – system operations/O&M
V. Progress Since Last Review (as applicable)	– protectiveness statements from last review – status of recommendations and follow-up actions from last review – results of implemented actions, including whether they achieved the intended purpose – status of any other prior issues
VI. Five-Year Review Process	– notification of potentially interested parties of start of review – identification of five-year review team members – components and schedule of your five-year review – document review – data review and evaluation – community notification – other community involvement activities – site inspection – site interviews

Exhibit 3-3: Contents of a Five-Year Review Report

The following report sections...	should include these topics when appropriate:
VII. Technical Assessment	*Question A: Is the remedy functioning as intended by the decision documents?* – remedial action performance and monitoring results – system operations/O&M – costs of system operations/O&M – opportunities for optimization – early indicators of potential remedy problems – implementation of institutional controls and other measures *Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?* – changes in exposure pathways – changes in land use – new contaminants and/or contaminant sources – remedy byproducts – changes in standards, newly promulgated standards, and TBCs – changes in toxicity and other contaminant characteristics – expected progress towards meeting RAOs – risk recalculation/assessment (as applicable) *Question C: Has any other information come to light that could call into question the protectiveness of the remedy?* – ecological risks – natural disaster impacts – any other information that could call into question the protectiveness of the remedy Summary of Technical Assessment – summary of findings and conclusions related to Questions A, B, and C
VIII. Issues	– issues that were identified during the technical assessment and other five-year review activities (*e.g.*, site inspection) – a determination of whether issues affect current or future protectiveness – a discussion of unresolved concerns or items raised by support agencies and the community (States, Tribes, other Federal agencies or departments, local governments, citizens, PRPs, other interested parties)
IX. Recommendations and Follow-up Actions	– list of any recommendations, including follow-up actions to ensure protectiveness – parties responsible for implementation – agencies with oversight authority – schedule for completion
X. Protectiveness Statement(s)	– protectiveness statement(s) developed at the OU level – protectiveness statement developed for the site as a whole at construction complete sites
XI. Next Review	– statement of when the next review is to be completed, or explanation of why no further five-year reviews are needed

3.7 How should I submit a Five-Year Review report?

The procedures for submitting reports to EPA Regions and Headquarters are described below. This process takes place after all reviews of draft reports, and other interagency reviews are completed, appropriate concurrences and signatures are obtained, and, to the extent practicable, issues are resolved.

3.7.1 How is an EPA-lead report submitted?

A report prepared by EPA is complete when it is signed by the EPA Regional Administrator or his/her designee. The Region should submit one copy of the signed Five-Year Review report to EPA Headquarters within ten days of the signature date. The Region should also place a copy of the report in each site information repository.

3.7.2 How is a Federal facility-lead report submitted?

When a Federal agency or department other than EPA conducts a five-year review, the report should be submitted to the Region for review pursuant to the terms of the Federal Facility Agreement or other authorized agreement. The Region should review the report for accuracy, protectiveness determination/statement, and the basis/support for such determination and consistency with this guidance. The EPA Regional Administrator or his/her designee should issue a memorandum that documents any unresolved items or concerns and either concurs with the report findings or provides EPA's own independent findings and protectiveness determination. Within ten days of the signature date of the memorandum, the Region should forward a copy of the report, with the memorandum attached, to EPA Headquarters, and a copy should be placed in each site information repository.

In some cases, EPA may have minimal involvement at the site or in the development of the Five-Year Review report or protectiveness statements. In such cases, Regions should determine whether to rely solely on the information presented by the other Federal agency or department without independent verification. When the Region relies solely on the representations of another Federal agency or department, the Regional Administrator or his/her designee should note this in the memorandum. It is important to consider who signed the Five-Year Review report at the other Federal agency or department. EPA expects that a Five-Year Review report generally will be signed by the other Federal agency or department at the senior management level.

3.7.3 How is a State or Tribal-lead report submitted?

When a State or Tribe conducts a five-year review, the report should be submitted to the respective Region for review of accuracy, protectiveness determination/statement and the basis/support for such determination and consistency with this guidance. The EPA Regional Administrator or his/her designee should issue a memorandum that documents any unresolved items or concerns and either concurs with the report findings and protectiveness statement(s) or provides EPA's own independent findings and protectiveness determination. Within ten days after the memorandum is signed, the Region should forward a copy of the report, with the memorandum attached, to EPA Headquarters and a copy should be placed in each site information repository.

3.8 What are the annual reporting requirements to EPA Headquarters?

Each EPA Region should report annually to EPA Headquarters on the progress of the five-year reviews for each of their sites. At a minimum, at the end of each fiscal year each Region should provide to EPA Headquarters the following:

- A list of sites that had five-year reviews due for that fiscal year;
- If a five-year review due date changes for any site, or a site no longer needs a five-year review, identify the sites and the basis for the change or discontinuation;
- A list of those sites where five-year reviews were completed;
- For each completed five-year review, a summary of the protectiveness determination(s), issues that impact protectiveness, follow-up actions, and the schedule and entity responsible for implementing such actions;
- Status of protectiveness when Five-Year Review reports from previous fiscal years made a "not protective" determination or "needed further information" before making a protectiveness determination, or deferred protectiveness; and
- Status of follow-up actions identified in Five-Year Review reports from previous fiscal years.

The exact date for submitting the annual report should be provided at the work planning sessions at the beginning of each fiscal year or through your Headquarters Regional Center contact.

[This page intentionally left blank.]

4.0 ASSESSING THE PROTECTIVENESS OF THE REMEDY

A five-year review should determine whether the remedy at a site is or upon completion will be protective of human health and the environment. The level of effort necessary to conduct a five-year review is site-specific and should be tailored appropriately for the remedial action and its stage of implementation. In general, five-year reviews of remedial actions under construction are narrower in scope than five-year reviews of remedies that have been constructed.

Your technical assessment of a remedy should examine the following three questions, which provide a framework for organizing and evaluating data and information and ensure that all relevant issues are considered when determining the protectiveness of the remedy:

- ***Question A*** – Is the remedy functioning as intended by the decision documents?
- ***Question B*** – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
- ***Question C*** – Has any other information come to light that could call into question the protectiveness of the remedy?

The following sections present Questions A, B, and C in more detail. Exhibit 4-1 summarizes a number of items that you should consider in answering questions A, B, and C in your evaluation of a remedial action.

Exhibit 4-1: Three Questions Used to Determine Whether a Remedy is Protective

When you ask...	you should consider whether...
Question A: Is the remedy functioning as intended by the decision documents?	• performance standards (*e.g.*, cleanup levels, plume containment, pumping rates) are or will likely be met; • there are problems with the remedy that could ultimately lead to the remedy not being protective or suggest protectiveness is at risk (*e.g.*, shrubs or bushes growing on a landfill cap that was designed to have a grass vegetative cover, extent of plume not fully delineated); • access (*e.g.*, fencing, security guards) and institutional controls needed at the particular stage of the remediation are in place and prevent exposure; • other actions (*e.g.*, removals) necessary to ensure that there are no exposure pathways that could result in unacceptable risks have been implemented; and • maintenance activities (*e.g.*, pumping and treating, monitoring slurry walls, mowing cap), as implemented, will maintain the effectiveness of response actions.

Exhibit 4-1: Three Questions Used to Determine Whether a Remedy is Protective

When you ask...	you should consider whether...
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?	• there are changes in standards identified as Applicable or Relevant and Appropriate Requirements (ARARs) in the ROD, newly promulgated standards, and/or changes in TBCs identified in the ROD, that could call into question the protectiveness of the remedy; • there are changes in land use or the anticipated land use on or near the site; • new human health or ecological exposure pathways or receptors have been identified; • new contaminants or contaminant sources have been identified; • there are unanticipated toxic byproducts of the remedy not previously addressed by the decision documents; • there are changes in the physical site conditions; and • there are changes in the toxicity factors for contaminants of concern.
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?	• ecological risks have been adequately addressed at the site, and/or there is a plan to address them through a future action; and • the site is/was subject to natural disasters, such as a 100-year flood.

4.1 Question A: Is the remedy functioning as intended by the decision documents?

In general, to determine if the remedy is functioning as described in the decision documents, you should first consider its implementation status, (*e.g.*, whether the remedy is under construction, operating, or completed). You should also look for available information about the remedy and compare it to the requirements in the decision documents and remedial design/construction specifications. For purposes of this guidance, definitions of remedial actions under construction, operating remedial actions, and completed remedial actions are as follows:

- ***Remedial actions under construction*** are those actions where physical construction has been initiated, but is not yet complete.

- ***Operating remedial actions*** are those actions that are ongoing, but where cleanup levels have not yet been achieved. Such actions typically have remedial components requiring several years to reach cleanup levels (*e.g.*, groundwater and surface water restoration, monitored natural attenuation, soil vapor extraction, and bioremediation).

- ***Completed remedial actions*** are those actions where construction is complete and cleanup levels have been achieved.

4.1.1 How do I answer Question A for a remedial action that is under construction?

In the case where a remedy is under construction, the focus of your review should be to determine if the remedy is being constructed in accordance with the requirements of the decision documents and design specifications, and if the remedy is expected to be protective when it is completed. In addition, you should confirm that access controls (*e.g.*, fencing, security guards) necessary at this stage of the remediation are in place and successfully prevent exposure. If the remedial action includes institutional controls (ICs), then your five-year review should also consider the implementation status of those controls. For example, answer the following questions: Have specific ICs been identified? Are there ICs needed at this stage of remediation to prevent exposure? Who is responsible for implementing ICs? What is the plan, schedule, and current status for IC implementation?

4.1.2 How do I answer Question A for a remedial action that is operating or completed?

Your review of an operating or completed remedial action generally will address more aspects of the remedy implementation than a review of a remedial action under construction. In general, you should assess the following:

- ***Remedial action performance*** – Determine whether the remedial action continues to operate and function as designed (*e.g.*, extent of groundwater plume is well defined and updated plume maps confirm containment), and has achieved, or is expected to achieve, cleanup levels.

- ***System operations/operation and maintenance (O&M)*** – Determine whether maintenance procedures, as implemented, will maintain the effectiveness of response actions. This evaluation might include, but is not limited to, visual inspection of the system and the review and evaluation of monitoring reports (*e.g.*, groundwater data from extraction and monitoring wells, biological monitoring data, discharge requirements, wetland monitoring data, leachate monitoring for containment remedies).

- ***Costs of system operations/O&M*** – Review and consider system operations/O&M costs if they are available. Compare actual/current annual O&M costs to the original cost estimate; large variances from the original cost estimate might indicate potential remedy problems. (Note: This information may not be readily available at Enforcement-lead sites, but should be requested.)

- ***Implementation of institutional controls and other measures*** – Determine whether access controls (*e.g.*, fencing, security guards) and ICs that are needed at this stage of the remediation are in place and successfully prevent exposure. If

ICs are not in place, determine why not, and obtain the schedule for implementation; determine whether other actions (*e.g.*, removals) necessary to ensure that exposure pathways that could result in unacceptable risks have been implemented.

- ***Monitoring activities*** **–** Determine whether monitoring activities required to ensure the effectiveness of the remedy (*e.g.*, performance and environmental data collected and results evaluated) are being conducted and whether they are adequate to determine the protectiveness and effectiveness of the remedy.

- ***Opportunities for optimization*** **–** If readily apparent during the course of conducting five-year review activities, identify any opportunities to improve the performance and/or reduce the costs of sampling and monitoring activities and operating treatment systems. If changes in these activities are recommended in the Five-Year Review report, you should also provide the rationale/basis for such changes. If appropriate, your report can also recommend that an optimization study be conducted.

- ***Early indicators of potential remedy problems*** **–** Investigate and identify problems that could lead to the remedy being not protective or suggest protectiveness is at risk unless changes are made. Problems could include frequent equipment breakdowns or replacement, or large variances in operating costs (if cost data are available). Some examples of indicators of potential remedy problems could include erosion and/or subsidence of a cap, trend analysis of sampling data showing no decrease in contaminant levels, monitoring data showing evidence of leachate migration, or that the extent of the groundwater contamination plume exceeds the outer reaches of the monitoring network.

4.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?

In conducting your five-year review, you should evaluate the effects of significant changes in standards and assumptions that were used at the time of remedy selection. Changes in the promulgated standards or "to be considereds" (TBCs) may impact the protectiveness of the remedy. Similarly, you should investigate the effect of significant changes in the risk parameters that were used to support the remedy selection, such as reference doses, cancer potency factors[12], and exposure pathways of concern. Finally, you should evaluate whether the original assumptions regarding current and future land/groundwater uses and contaminants of concern are

[12] Note that risk parameters in EPA publications such as the Integrated Risk Information System (IRIS) (see http://www.epa.gov/IRIS) are guidance only, and should be applied only as appropriate for the remedy being reviewed.

still valid, and whether any physical features (or understanding of physical sites conditions) have changed (*e.g.*, changes in anticipated direction or rate of groundwater or identification of a new groundwater divide). All of these factors may have a bearing on the validity of the remedial action objectives and may affect the protectiveness of the remedy.

Exhibit 4-2 presents a series of example questions that you should consider in determining whether the exposure assumptions and toxicity data used at the time of remedy selection are still valid and, if you determine that they are no longer valid, whether they call into question the protectiveness of the remedy. Exhibit 4-2 also groups the questions according to the type of assumption.

Exhibit 4-2: Example Questions to Determine if Assumptions Upon Which the Remedy was Based Have Changed

For an assumption based on ...	**an example question may be...**
standards and TBCs	Are there changes in the standards identified as ARARs in the ROD that bear on the protectiveness of the remedy? Are there newly promulgated standards that might apply or be relevant and appropriate to the site and that bear on the protectiveness of the remedy? Are there changes in TBCs identified in the ROD that bear on the protectiveness of the remedy?
cleanup levels	What is the basis for each cleanup level identified in the ROD (*e.g.*, risk-based or promulgated standards as ARARs)? Have there been changes to the basis of the cleanup levels? (See sample questions for "standards or TBCs" above, and for "toxicity and other contaminants characteristics" below.)
exposure pathways	Has land use or expected land use on or near the site changed (*e.g.*, industrial to residential, commercial to residential)?
exposure pathways	Have any human health or ecological routes of exposure or receptors changed or been newly identified (*e.g.*, dermal contact where none previously existed, new populations or species identified on site or near the site)?
exposure pathways	Are there newly identified contaminants or contaminant sources?
exposure pathways	Are there unanticipated toxic byproducts of the remedy not previously addressed by the decision documents (*e.g.*, byproducts not evaluated at the time of remedy selection)?
exposure pathways	Have physical site conditions changed such that protectiveness may be affected (*e.g.*, changes in anticipated direction or rate of groundwater flow)? Has understanding of physical site conditions changed (*e.g.*, identification of a new groundwater divide)?
toxicity and other contaminant characteristics	Have toxicity factors for contaminants of concern at the site changed (*e.g.*, Integrated Risk Information System (IRIS) evaluations? (See http://www.epa.gov/IRIS) Have other contaminant characteristics changed? Have ecological toxicity reference values and/or ecological "no observed adverse effect levels/lowest observed adverse effect" (NOAELs/LOAELs) levels changed.

4.2.1 How should I check the impact of changes in standards and TBCs?

Cleanup levels or actions may be based on ARARs identified in the Record of Decision (ROD) (as opposed to calculated site-specific risk, as discussed in Section 4.2.3). For example, the cleanup levels for a groundwater remedy may be based on the Safe Drinking Water Act maximum contaminant levels (MCLs) if these were identified as ARARs in the ROD.

In the preamble to the final National Contingency Plan (NCP), EPA states its policy that it will not reopen remedy selection decisions contained in RODs (*i.e.*, ARARs are normally frozen at the time of ROD signature) unless a "new or modified requirement calls into question the protectiveness of the selected remedy." 55 FR 8757 (March 8, 1990). The preamble goes on to state that "a policy of freezing ARARs at the time of ROD signing will not sacrifice protection of human health and the environment because the remedy will be reviewed for protectiveness every five years, considering new or modified requirements at that point, or more frequently, if there is reason to believe that the remedy is no longer protective of health and environment." 55 FR 8758 (March 8, 1990). The preamble also states that a remedy would not necessarily need to "be modified solely to attain a newly promulgated or modified requirement," but that "newly promulgated or modified requirements contribute to [the] evaluation of protectiveness." 55 FR 8758 (March 8, 1990).

Therefore, although ARARs generally are "frozen" at the time of ROD signature, in conducting a five-year review, you should determine the effect of a newly promulgated or modified standard on the protectiveness of the remedy originally selected in the ROD. You should evaluate the newly promulgated or modified requirement to determine if the cleanup level established in the ROD remains protective. TBCs may also have been used to select cleanup levels. Therefore, you should also review any new or modified TBCs to ensure that any changes will not impact the protectiveness of the remedy.

Generally, you should only consider changes in standards that were identified as ARARs in the ROD, newly promulgated standards for chemicals of potential concern, and TBCs identified in the ROD that bear on the protectiveness of the remedy. As such, you should review any newly promulgated standards, including revised chemical-specific requirements (such as MCLs, ambient water quality criteria), revised action and location-specific requirements, and State standards if they were considered ARARs in the ROD.

In evaluating a change in a standard that was identified as an ARAR in the ROD, or a newly promulgated standard or TBC, you should establish whether the new requirement indicates that the remedy is no longer protective. You should recommend a follow-up action when the remedy is not protective. For example, based on revised risk information for a specific chemical, a new standard (*e.g.*, more stringent MCL for a chemical) may result in a situation where the cleanup level to be achieved by the original remedy would pose a 10^{-3} cancer risk. In that circumstance, the five-year review could recommend that a new cleanup level based on the new standard be adopted and, if necessary, that the remedy be modified. However, a change in a standard may not necessarily result in a change in the resulting risk and therefore may not always impact protectiveness. An illustration of a method and an example for evaluating changes in standards is provided in Appendix G, "Methods and Examples for Evaluating Changes in Standards and Toxicity," Exhibit G-1, "Evaluating Changes in Standards," Exhibit G-2, "Hypothetical Scenario for a Change in a Standard," and Exhibit G-3, "Decision Process for a Hypothetical Change in Standard."

4.2.2 How should I check the impact of changes in exposure pathways?

You should consider changes in site conditions that could result in increased exposure. These changes could include changed or new land uses, including zoning changes, changed or new routes of exposure or receptors, changed physical site conditions that may affect the protectiveness of the remedy, new contaminants, or a new understanding of geological conditions. In evaluating this information, you should work closely with a risk assessor to establish the impact that such changes may have on the estimated risk associated with your site. Depending on the significance of the changes, it may be necessary for you to recalculate human health risk and re-examine ecological risks. Generally, your human health determination should be based on whether the cancer risk could now be greater than 10^{-4} and/or the hazard index could be greater than 1 for non-carcinogenic effects.

In some cases, it may be necessary to revise or expand the previous risk assessment as part of your five-year review. For example, you may need to revise the risk assessment when there is a new exposure pathway, a new potential contaminant of concern, or an unanticipated toxic byproduct of the remedy. In all cases, you should evaluate whether the remedy can mitigate any unacceptable risk or whether additional actions may need to be taken. Your five-year review can also recommend further investigation to determine whether an additional response action is needed.

4.2.3 How should I check the impact of changes in toxicity and other contaminant characteristics?

Cleanup levels at a site may be based on the calculated risk for chemicals and/or media where there are no promulgated standards (*e.g.*, site-specific soil and sediment action levels) or existing standards are not sufficiently protective for site-specific conditions. If the remedy is intended to meet a site-specific, risk-based cleanup level, you should check to see whether toxicity or other contaminant characteristics used to determine the original cleanup level have changed. In addition to toxicity, you should examine other contaminant characteristics that determine the nature and extent of contaminant migration and effects on receptors (*e.g.* sorption characteristics, ability to bioaccumulate, bioavailability). If there have been changes in the understanding or in our knowledge of these physical/chemical characteristics, you may need to recalculate risk using the original cleanup level or using the current concentration if it has not been identified as a contaminant of concern. An increase in the cancer slope factor, for example, may suggest that the risk from a chemical concentration is above the generally acceptable cancer risk range (10^{-4} to 10^{-6}). You should also consider changes in toxicity and other contaminant characteristics relating to ecological receptors.

You may work with your Region's risk assessor to determine whether there have been changes in toxicity or other contaminant characteristics and whether further investigation is needed. The risk assessor is also familiar with efficient use of the Superfund Technical Support Center and its hotline. One preferred resource for checking changes in toxicity information is EPA's Integrated Risk Information System (IRIS) (http://www.epa.gov/IRIS). However, many contaminants found at Superfund sites are not found in IRIS. You may find it useful to refer to the Superfund Risk Assessment Tools of the Trade page for databases and additional links and pointers (http://www.epa.gov/superfund/programs/risk/tooltrad.htm#gp). Beginning in the summer of 2001, this page should link risk-based concentration tables which provide screening levels for specific exposure scenarios, a risk calculation tool, and should identify recent toxicity data and their sources.

The flowchart presented in Appendix G, Exhibit G-4, "Evaluating Changes in Toxicity and Other Contaminant Characteristics," shows the process you should use to evaluate the significance of changes in toxicity values and other contaminant characteristics when conducting a five-year review. You should first identify any site-specific, risk-based, cleanup levels and investigate relevant changes in contaminant characteristics. If the estimated risk for a contaminant has not changed, your analysis on this point should be complete.

If the estimated risk has increased, then you should determine whether the new estimated risk is acceptable. In most cases, you should base this determination on whether the risk is within or below the generally acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic risk and the hazard index is below 1 for non-carcinogenic effects. If the estimated risk is not protective, you should determine what actions need to be taken to achieve an acceptable level of risk. Appendix G, Exhibit G-5, "Hypothetical Scenario for a Change in Toxicity," and Exhibit G-6, "Decision Process for a Hypothetical Change in Toxicity," provide an example of the evaluation process when there are changes in toxicity and other characteristics. Note: Future guidance will address the appropriateness of using various statistical methods in making the determination about when remedial action objectives (RAOs) have been attained.

4.2.4 How should I review RAOs and evaluate their impact?

As part of the five-year review, you should conduct an evaluation of the RAOs stated in the ROD to determine whether the remedy is meeting or will meet RAOs. Depending on the outcome of the evaluation, you may find it necessary to modify the RAOs, modify the remedy, or conduct further response actions. For example, an RAO phrased in terms of "achieving the drinking water standard in ten years" may be significantly affected by a new MCL that establishes a more stringent standard. Conversely, an RAO may be general enough to accommodate a new or modified requirement.

If your evaluation of data indicates that the remedy is not meeting and will not be able to meet the RAO stated in the ROD, then you may need to determine if the remedy is protective and, if not protective, what additional actions are needed. For example, if the risk associated with the cleanup levels currently being achieved by the remedy are within EPA's acceptable risk range, the remedy generally should be considered protective. However, if the remedy will not be able to meet the RAOs, further actions may be needed, depending on the specificity of the original RAOs in the ROD. Your Five-Year Review report should identify such further actions as recommendations and/or follow-up actions.

New site conditions, such as discovery of new contaminants, can also impact the RAOs and remedy protectiveness. During your five-year review, you should evaluate whether the RAOs in the ROD are sufficiently comprehensive to cover any new or changed conditions at a site. If a new condition at the site is not covered by the RAOs, you should recommend further investigation in the Five-Year Review report to determine whether additional response actions are needed.

Further response actions may not necessarily involve additional physical construction activities but could include sampling, studies, and/or investigations. For example, modifying RAOs will require a ROD Amendment, but does not require a physical site activity.

4.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

You should consider any other information that comes to light that could call into question the protectiveness of the remedy. It is expected that most considerations related to the protectiveness of the remedy will be covered by Questions A and B. However, in some instances, there may be other factors about the remedy or the site that you should consider during the review.

Situations to watch for include the following:

- Ecological risks have not been adequately addressed at a site, and there is not a plan to address them through a future action;
- The site, although located entirely above the 500-year flood boundary, was partially inundated by a 100-year flood (which now may require a flood plain redesignation of the region); and
- Land use changes that are being considered by local officials.

If ecological risks have not been adequately addressed at a site, and there is not a plan to address them through a future action, then you may need to address them by conducting a screening ecological risk assessment as part of the Five-Year Review using *Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites*, OSWER

Directive 9285.7-28P (October 7, 1999). The ecological risk assessor on your team can help streamline the process appropriately.

4.4 How should I develop the conclusions of my five-year review?

The conclusions of your five-year review should include: 1) an identification of issues; 2) recommendations and follow-up actions; and 3) a determination of whether the remedy is, or is expected to be, protective of human health and the environment. You should arrive at these conclusions through a technical assessment of the information collected during the document review, data collection, interviews, site inspection, and other activities. Your evaluation should focus on the information collected through answering the three questions shown in Exhibit 4-1. (See Sections 4.1, 4.2, and 4.3, above, for a detailed discussion of how to assess the remedy by answering these three questions.) These conclusions should be documented in the Five-Year Review report as a technical assessment summary.

4.4.1 How should I identify issues?

You should identify all issues that currently prevent the response action from being protective, or may do so in the future. You should document all such issues and follow-up actions needed to ensure the proper management of the remedy in your Five-Year Review report. You should also identify early indicators of potential remedy problems. Early indicators of remedy problems may include operating costs that are greater than originally anticipated. For instance, excessive replacement of pumps or other equipment may indicate the need to reconsider system design or re-evaluate aquifer conditions.

Examples of issues that may be identified in a Five-Year Review report include the following:

- Inadequate access controls (*e.g.*, fencing has been breached, or fencing is not adequate to restrict access);
- Incomplete response action, including ICs (*e.g.*, environmental easements or well restrictions are not in place);
- Inadequate ICs (*e.g.*, well restrictions are in place but are not preventing exposure);
- Response action is not expected to achieve cleanup levels; plume containment has not been confirmed or achieved;
- Cleanup levels are not protective due to changes in chemical characteristics;
- Discharge requirements are exceeded;
- Inadequate operation and maintenance of physical remedial structures (*e.g.*, vegetative cover of cap mowed infrequently);

- Differences found in actual or proposed land use other than those assumed in the selection of the response action;
- RAOs will not be achieved;
- Monitoring is not being completed in a timely manner; and
- Inadequate monitoring activities to determine the protectiveness of the remedy (*e.g.*, the number and location of monitoring wells are not appropriate for monitoring remediation progress of the groundwater contamination plume).

You should describe each issue in sufficient detail so that EPA can appropriately track the progress to resolution. For each issue, you should determine if it currently affects the protectiveness of the remedy or may do so in the future.

Exhibit 4-3 provides an example of a tabular format that you can use to list issues in your Five-Year Review report.

Exhibit 4-3: Example Table for Listing Issues

Issues	**Affects Protectiveness (Y/N)**	
	Current	**Future**

4.4.2 When and how should I develop recommendations?

For each issue identified, the Region should document and ensure implementation of recommendations to resolve those issues. These recommendations should be identified along with follow-up actions in your Five-Year Review report. Follow-up actions should be completed to ensure long-term protectiveness of the remedy, or to bring about protectiveness of a remedy that is currently not protective. You may also have follow-up actions where a protectiveness determination cannot be made at the time of the five-year review. In addition, you may wish to make additional recommendations that do not directly relate to achieving or maintaining the protectiveness of the remedy, such as activities related to O&M of the remedy and coordination with other public and government authorities.

The following are types of recommendations that generally are considered appropriate as part of a five-year review:

- ***Provide additional response actions*** **–** For example, additional response actions may be necessary to ensure protectiveness if new risk information indicates that a remedy is not protective (*e.g.*, a treatment process will not be able to achieve soil cleanup levels). EPA may implement such further response any time pursuant to CERCLA §104 or §106 authority. In your Five-Year Review report, you can recommend further investigation and the implementation of further response actions.

- ***Improve O&M activities*** **–** For example, when a cap's vegetative cover is not mowed on a regular basis and/or vegetation other than that specified in the remedial construction contract specifications is present, you may recommend that actions be taken to improve compliance with the O&M Manual/Plan. The lack of O&M activities can lead to more serious remedy problems if not addressed. Your Five-Year Review report should recommend that O&M activities be conducted if they currently are not being performed or inadequately conducted and, if needed, expanded, reduced, or terminated. The report should also provide the rationale/basis for any of these recommendations.

- ***Optimize remedy*** **–** For example, when the limits of a groundwater plume have contracted due to pumping, and some monitoring wells no longer register contamination levels above cleanup levels, it may be appropriate to revise the sampling plan to eliminate these wells from the sampling routine or reduce the frequency of their sampling. It may also be possible to remove specific groundwater extraction wells from service and increase or reduce the pumping rate on others to optimize groundwater remediation. Similarly, it may be possible to remove treatment units that no longer contribute to the achievement of remedial goals.

- ***Enforce access controls and ICs*** **–** For example, when repeated site trespassing has been observed, you could recommend repair of the fence and an evaluation of the need for additional security measures. When you have evidence that groundwater wells continue to be installed despite well restrictions that are currently in place, you can recommend an evaluation of the need for further enforcement of institutional controls (*e.g.*, prohibit well drilling).

- ***Conduct additional studies or investigations*** **–** For example, after reviewing and evaluating all available data and information it is apparent that contaminant levels have not decreased as expected in the estimated time frame. Additional information will be needed to determine if the remedy, as is, will be able to achieve remediation goals within the estimated time frame. Other studies may include, but are not limited to, site characterization, ecological assessment, focused feasibility studies, groundwater modeling, treatability studies, and/or sampling.

For each recommendation, you should identify the party responsible for implementation, the agency with oversight authority, a recommended schedule for implementation and completion, and the impact, if any, on current or future protectiveness. Exhibit 4-4 provides an example of a table that you can use in your Five-Year Review report for documenting both recommendations and follow-up actions.

Exhibit 4-4: Example Table for Listing Recommendations and Follow-up Actions

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current	Future

Regions should track the progress and completion of recommendations and/or followup actions with documentation in the site file, and upon completion update the administrative record in the site information repository. See Section 3.8 for annual reporting responsibilities to EPA Headquarters.

4.5 How do I determine protectiveness?

After addressing Questions A, B, and C, you should be ready to determine the protectiveness of the remedy or remedies at a site and to document the rationale for your determination(s). You should make a protectiveness statement for each OU and an additional, comprehensive site-wide protectiveness statement for those sites that have reached construction completion.

Your determination of whether the remedy remains protective of human health and the environment generally should be based on the answers to Questions A, B, and C and the information obtained in the process of answering them. Although protectiveness generally is defined by the risk range and hazard index (HI), your answers to Questions A, B, and C may identify other factors and issues that may impact the protectiveness of a remedy.

At the end of your technical analysis and evaluation, if the answers to Questions A, B, and C are *yes, yes, and no*, respectively, then your remedy normally should be considered protective. However, if the answers to the three questions are other than *yes, yes, no,* depending on the elements that affect each question, your remedy may be one of the following:

- Protective;
- Will be protective once the remedy is completed;
- Protective in the short-term; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken;
- Not protective, unless the following action(s) are taken in order to ensure protectiveness; or
- Protectiveness cannot be determined until further information is obtained. (A time frame should be provided when a protectiveness determination will be made. This should be done through an addendum. If this is the case, your next five-year review should be due five years from the date this report is signed, not the signature date of the addendum).

Even if there is a need to conduct further actions, it does not mean that the remedy is not protective. Normally, the remedy should be considered as not protective when the following occur:

- An immediate threat is present (*e.g.* exposure pathways that could result in unacceptable risks are not being controlled);
- Migration of contaminants is uncontrolled and poses an unacceptable risk to human health or the environment;
- Potential or actual exposure is clearly present or there is evidence of exposure (*e.g.*, institutional controls are not in place or not enforced and exposure is occurring); or
- The remedy cannot meet a new cleanup level and the previous cleanup level is outside of the risk range.

Exhibit 4-5 presents examples of protectiveness determinations. These examples cover only some of the possible situations you may observe at your site but should serve to guide your decision-making.

Exhibit 4-5: Examples of Protectiveness Determinations

1. Remedies Under Construction			
If the remedy involves...	**and you observe in your five-year review that...**	**then your answers to Questions A, B and C should be...**	**and...**
any remedial action under construction	• no changes to site conditions or any other parameters would impact protectiveness	A - Yes B - Yes C - No	the remedy will be protective.
a groundwater pump-and-treat system expected to operate for 30 years with institutional controls to restrict well drilling of groundwater wells	• an MCL for one of the contaminants of concern (COCs) has become more stringent since the ROD was signed; and the risk associated with the previous MCL is now outside of the risk range; • the remedy cannot meet the new standard (even with design modifications); and • ICs are in place,	A - Yes B - No C - No	the remedy is not protective because the remedy is not able to meet the new standard (ARAR) and the previous MCL is outside of the risk range. However, since ICs are in place there are no current exposures. Recommend that follow-up actions be taken to address the new MCL (ARAR) issue.
rerouting of contaminated surface runoff from tailings	• remedy in the ROD did not address ecological risks; • sediment sampling data from adjacent wetlands indicate high levels of heavy metals; • there were dead fish, and land animals with physical abnormalities; or • an ecological risk assessment was not previously conducted,	A - Yes B - Yes C - Yes	defer protectiveness because more information is needed to make a protectiveness determination. Recommend that follow-up actions be taken to address inadequate ecological risk data.

Question A – Is the remedy functioning as intended by the decision documents?
Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

Exhibit 4-5: Examples of Protectiveness Determinations

2. Operating Remedies

If the remedy involves...	and you observe in your five-year review that...	then your answers to questions A, B and C should be...	and...
any operating remedy	• no changes to site conditions or any parameters under Questions A, B, and C occurred,	A - Yes B - Yes C - No	the remedy is protective.
groundwater pump-and-treat system expected to operate for 15 years with ICs to restrict well drilling	• no well drilling restriction in place as required by ROD; • there is no known current exposure to groundwater, based on site visits, interviews with local officials and residents,	A - No B - Yes C - No	the remedy is considered protective in the short-term, because there is no evidence that there is current exposure. However, in order for the remedy to remain protective in the long-term, ICs restricting well drilling must be put in place.
groundwater pump-and-treat for 20 years; ICs restricting well drilling; RAO: restore groundwater to drinking water standards	• based on data and current groundwater modeling, the RAOs will not be met; • ICs are in place; • the system has been operating for ten years; • there are no changes in standards or contaminant characteristics for COCs; • there are no new standards; • contaminant levels of COCs have leveled off in the last five years; • optimization efforts have not been effective in further decreasing COC levels; • current levels of contamination are within EPA's risk range, however, RAOs have not yet been achieved,	A - No B - No C - No	the remedy is considered protective in the short-term because ICs are in place, and therefore, there is no current or potential exposure. Follow-up actions are necessary to address long-term protectiveness because RAOs are not expected to be met. Recommend that the remedial action objectives may need to be reevaluated and other potential actions be further evaluated.

Question A – Is the remedy functioning as intended by the decision documents?
Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

Exhibit 4-5: Examples of Protectiveness Determinations

If the remedy involves...	**and you observe in your five-year review that...**	**then your answers to questions A, B and C should be...**	**and...**
groundwater pump-and-treat for 10 years; ICs on well drilling; RAO: groundwater restoration to beneficial use	• ICs are in place; • there is a new State MCL for one of the COCs; • the standard (ARAR) in the original ROD is still protective because it is within the same order of magnitude as the new State MCL and remains within EPA's risk range; • there is no current exposure - residents with private wells in the area are on alternate water supply; • the State considers all groundwater to be a potential source of drinking water (However, there is no Comprehensive State Groundwater Protection Plan [CSGWPP]); and • the existing remedy (system) can achieve the new MCL,	A - Yes B - No C - No	the remedy is considered protective because the cleanup levels are still within EPA's risk range and there is no current or potential exposure.

Question A – Is the remedy functioning as intended by the decision documents?
Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

Exhibit 4-5: Examples of Protectiveness Determinations

If the remedy involves...	and you observe in your five-year review that...	then your answers to questions A, B and C should be...	and...
groundwater pump-and-treat for 20 years; ICs restricting well drilling; RAO: groundwater restoration to drinking water standards	• ICs are in place; • new Federal standard for one of the COCs; • the standard (ARAR) in the original ROD is still protective, within EPA's risk range; • no current or potential exposure to groundwater; and • existing remedy can remediate groundwater to the new standard,	A - Yes B - No C - No	the remedy is considered protective because cleanup levels are still within the risk range and there is no current or potential exposure. However, if the new MCL is not met, the groundwater will not meet the RAO of restoration to drinking water standards. Recommend consideration of follow-up actions to address the new standard and the issue of not achieving the RAO. However, in this case, the remedy can meet the new standard, and therefore, another option is to recommend that the new standard be adopted as the new cleanup level, which would then allow you to achieve the original RAOs. Adopting a new cleanup level would have to be done through the remedy decision process with a ROD Amendment or Explanation of Significant Differences (ESD).

Question A – Is the remedy functioning as intended by the decision documents?
Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

Exhibit 4-5: Examples of Protectiveness Determinations

3. Completed Remedies			
If the remedy involves...	**and you observe in your five-year review that...**	**then your answers to questions A, B and C should be...**	**and...**
any remedy that is complete with a five-year review requirement	• there were no changes to site conditions or parameters under questions A, B, and C,	A - Yes B - Yes C - No	the remedy is protective.
capping of 30-acre landfill with ICs to prevent disturbance of cap	• ICs were never put in place; • mowing and cap maintenance activities are ongoing and adequate; • there is no cracking, sliding, settlement of cap or other indicators of cap breaches; and • there is no evidence of an exposure (human or ecological),	A - No B - Yes C - No	the remedy is considered protective in the short-term because there is no evidence of a cap breach and thus no current exposure. However, in order for the remedy to remain protective in the long-term, ICs must be put in place.
groundwater pump-and-treat for 10 years; ICs restricting well drilling; RAO: restore groundwater to drinking water standards; cleanup goals were achieved and RAOs were met (third five-year review is being conducted as a matter of policy in order to facilitate the deletion process)	• there is a new standard for one of the COCs; • Standard in original ROD (ARAR) is now outside of the risk range (due to a change in toxicity); and • ICs are no longer in place because RAOs were met last year,	A - Yes B - No C - No	the remedy is not protective because the standard in the ROD is no longer within the risk range and therefore no longer protective. In addition, the RAO is no longer being met. Recommend follow-up actions necessary to make remedy protective and deletion should not occur until this issue is resolved.

Question A – Is the remedy functioning as intended by the decision documents?
Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

Exhibit 4-5: Examples of Protectiveness Determinations

If the remedy involves...	and you observe in your five-year review that...	then your answers to questions A, B and C should be...	and...
excavation and disposal of top two feet of contaminated soil; ICs prohibiting residential and recreational use of the property; RAO: cleanup site to allow for industrial use; site was deleted three years ago	• ICs are still in place; • the remedy is intact, no physical disturbances, top two feet of clean soil remain undisturbed; and • the local government is considering changing the zoning of the property to allow for recreational use,	A - Yes B - Yes C - No	the remedy is considered to be currently protective. However, should the zoning of the property change to recreational use, the remedy may no longer be protective. Recommend follow-up actions with local officials to ensure that in the event that zoning changes the remedy will remain protective.

Question A – Is the remedy functioning as intended by the decision documents?
Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

4.5.1 How do I formulate protectiveness statements?

You should develop a protectiveness statement for each OU at which a remedial action has been initiated. For sites that have reached construction completion and have more than one OU, you should develop an additional comprehensive site-wide protectiveness statement covering all of the remedies at the site. You should not include this additional protectiveness statement until construction completion because, until then, all remedies at the site may not necessarily have been selected and constructed.

In order to promote consistency, you are strongly encouraged to model your protectiveness statements on the sample protectiveness statements provided in Exhibits 4-6 and 4-7. Your Five-Year Review report should present the protectiveness statements at the beginning of a discussion that should explain and provide the supporting rationale of the protectiveness determination.

Exhibit 4-6: Protectiveness Statements

If the remedial action at the OU is:	then use this statement ...
under construction and...	
protective or will be protective	"The remedy at OU X is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."
not protective	"The remedy at OU X is not protective because of the following issue(s) (describe each issue). The following actions need to be taken (describe the actions needed) to ensure protectiveness."
protectiveness deferred	" A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions (describe the actions). It is expected that these actions will take approximately (insert time frame) to complete, at which time a protectiveness determination will be made."

Exhibit 4-6: Protectiveness Statements

If the remedial action at the OU is:	then use this statement ...
operating or completed and...	
protective	"The remedy at OU X is expected to be protective upon completion or is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."
protective in the short-term	"The remedy at OU X currently protects human health and the environment because (describe the elements of the remedy that protect human health and the environment in the short term). However, in order for the remedy to be protective in the long-term, the following actions need to be taken (describe the actions needed) to ensure long-term protectiveness."
not protective	"The remedy at OU X is not protective because of the following issue(s) (describe each issue). The following actions need to be taken (describe the actions needed) to ensure protectiveness.
protectiveness deferred	" A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions (describe the actions). It is expected that these actions will take approximately (insert time frame) to complete, at which time a protectiveness determination will be made."

Exhibit 4-7: Comprehensive Protectiveness Statements for Sites That Have Reached Construction Completion

If the remedy(ies) is/are ...	then use this statement:
protective	"Because the remedial actions at all OUs are protective, the site is protective of human health and the environment."
not protective	"The remedial actions at OUs X and Y are protective. However, because the remedial action at OU Z is not protective, the site is not protective of human health and the environment at this time. The remedial action at OU Z is not protective because of the following issue(s) (describe each issue). The following actions need to be taken (describe the actions needed) to ensure protectiveness."

Appendix A
Community Involvement

[This page intentionally left blank.]

Community Involvement

This appendix provides a brief discussion about community involvement during the five-year review with a focus on the role of the 40 CFR §300 Community Involvement Coordinator (CIC), community involvement activities, notifying the community, additional recommended activities at high visibility sites, elements of a communications strategy, interviewing members of the community, an example timeline of communication activities, and sources for additional information on community involvement.

What is the role of the Community Involvement Coordinator (CIC)?

The Community Involvement Coordinator (CIC) serves as a public participation and communications advisor. It is his/her job to ensure effective communications with the community. You should consult with the CIC about the most appropriate methods for notifying and involving the community in the five-year review process. The CIC may advise, develop and implement activities designed to notify the community and to involve the community. Part of the community involvement process should involve reviewing the existing Community Involvement Plan (CIP) for the site. The CIP typically describes the history of the site, including any community involvement activities conducted in the past or special needs of the community. Many changes may have taken place in the community since the CIP was last revised or since the last five-year review. For example, the demographics of the community may have changed and new businesses and residents may live in the area. Some residents may speak a language other than English. The CIC can arrange for an interpreter and written materials can be translated into the appropriate language.

When should I begin community involvement activities?

You should begin working with the site's Regional CIC during the initial planning stages of the five-year review to determine the appropriate level of community involvement for the five-year review.

What points should be covered in notifying the community?

At a minimum, community involvement activities during the five-year review should include notifying the community that the five-year review will be conducted and notifying the community when the five-year review is completed. The CIC can recommend appropriate communication vehicles for notifying the public (*e.g.*, publishing a public notice in the newspaper, radio announcement, etc).

The site team should determine the best means for notifying the community that the five-year review process is underway. In some communities, holding an open house or public meeting where community members may stop by and ask questions or pick up fact sheets, brochures, etc., may work effectively. Other activities may include broadcasting a public service announcement on radio or television and mailing, posting, or handing out a fact sheet. Depending on the nature of the site and the interest in the community, another option for involving the public is to provide a public comment period on the findings of the five-year review.

Notice to the community that a five-year review will be conducted should at a minimum provide:

- The site name, its location and web address (if available);
- The lead agency conducting the review;
- A brief description of the selected remedy;
- A summary of contamination addressed by the selected remedy;
- How the community can contribute during the review process;
- A contact point and phone number for further information; and
- The scheduled date of completion of the five-year review.

Notice to the community that a five-year review has been completed should include some of the information given in the initial notice plus additional information. At a minimum, the notice that a five-year review has been completed should include:

- The site name, its location, and web address (if available);
- The lead agency conducting the review;
- A brief description of the selected remedy;
- A summary of contamination addressed by the selected remedy as provided in the initial notice;
- A brief summary of the results of the five-year review;
- The protectiveness statement(s);
- A brief summary of data and information that provided the basis for determining protectiveness, issues, recommendations, and follow-up actions directly related to the protectiveness of the remedy;
- Location(s) where a copy of the five-year review can be obtained or viewed (including site repositories);
- A contact name and telephone number where community members can obtain more information or ask questions about the results; and
- The date of the next five-year review or a statement and supporting rationale that five-year reviews will no longer be required.

Are there any additional recommended activities that I should consider at high visibility sites?

At high profile sites or those with significant public interest, you should carefully consider methods for informing the community about the review. You should determine if additional or enhanced community involvement activities are appropriate. During the five-year review, active community members may be interested in some or all of the following topics:

- The five-year review process;
- How community members or groups can contribute information about site activities;
- Where to find written documentation about the review;
- What the protectiveness statements mean; and
- What happens after the review is complete, especially if the remedy is found to be not protective.

The CIC and other review team members that have knowledge of the community's needs and interests should be involved in decisions about the level of community involvement and appropriate activities.

What elements should I include when developing a communication strategy?

It is always a good idea to develop a communication strategy for high profile sites. This strategy should:

- Describe the public's concerns and communication needs;
- Identify specific communication activities that you plan to conduct;
- Outline a proposed schedule for these activities, and assign responsibilities for carrying them out; and
- Present expected results.

Consult Section V of the *Superfund Community Involvement Handbook (OSWER Directive 9230.0-94) and Toolkit (OSWER Directive 9230.0-95)* for an example of a communication strategy. This strategy does not need to be added to the official record, and can be as informal or detailed as community needs demand.

How should I approach interviewing members of the community?

In addition to notifying the community about the five-year review, you and the CIC, in conjunction with the site team, should consider interviewing community members (especially those living near the site) to get their views about site conditions and related concerns. If there is a Community Advisory Group or a group with a Technical Assistance Grant related to the site, they should be briefed at the outset of the five-year review process in addition to other interviews you may conduct.

You, the CIC, and other team members should review the community profile in the CIP to obtain useful information about the community, such as business owners or residents living near the site, and the past level of interest from individuals and groups in the community. The CIP can also be a source for identifying other stakeholders who have been active in site activities in the past and who could provide additional information about site conditions.

Other important sources of information are local officials. In many cases, the CIC may be the best person to consult local officials, because they may have met or spoken with them previously and established rapport.

See Appendix C, "Five-Year Review Interviews," for additional information about conducting interviews as part of a five-year review.

What is the timeline for communication activities during a five-year review?

Table 1, "Major Communication Milestones During a Five-Year Review," outlines the major communication milestones during a five-year review and a suggested time frame for conducting communication activities, especially at high profile sites or those with a strong public interest. Consult the *Superfund Community Involvement Handbook and Toolkit* to determine which activities may be best suited for your community at each stage, and for details on the time frame and effort needed for each activity. Activities may be conducted before or at the outset of your five-year review and during or close to the time of the site inspection, depending on the community needs. Activities that you should conduct for all five-year reviews are identified in Table 1 with bolded text.

Table 1: Major Communication Milestones During a Five-Year Review

When you or the CIC...	you should...
Planning the Review and Notifying the Community	
1. review the existing CIP for potentially helpful information (the CIC should lead this effort),	begin planning immediately, so that if interaction with the community is needed, it is provided up-front.
2. develop a communication strategy,	prepare a communication strategy before notifying the community. Circumstances and the level of public interest may change throughout the process, so refer to and update the strategy regularly.
3. notify the community that the five-year review will begin, using a communication activity appropriate to the specific community,	notify the community that the five-year review process is beginning before the site inspection.
Consulting the Community	
4. interview community members to gather additional information about the site,	plan for about one month of coordination and gathering of information, depending on whether contact with the community is via telephone, in person, etc.
Communicating the Results of the Five-Year Review	
When you or the CIC...	**you should...**
5. plan and conduct additional communication activities tailored to community needs at each site,	plan your activities before releasing the results of the five-year review to the public. Try to complete these activities before the release of the report or within six months after the Five-Year Review report is complete.
6. notify the community that the Five-Year Review report is complete, prepare and distribute a brief summary of the results, and place the report in the site information repositories,	provide this information as quickly as possible after the Five-Year Review report is completed. Consult with the CIC before preparing the summary to determine which communication mechanism is most appropriate to the community's needs.

Note: Bolded activities are required

More Information on Community Involvement

For more information on community involvement activities, please consult the following sources:

- ***The Superfund Community Involvement Handbook (OSWER Directive 9230.0-94) and Toolkit (OSWER Directive 9230.0-95).*** This two-volume handbook and toolkit includes guidance on community involvement policy throughout the Superfund pipeline, including special chapters on working at Federal facilities, risk communication, and multimedia sites. The toolkit components describe and provide over 100 tools that CICs can use to make their jobs easier, such as electronic and hard copy templates for public notices, press releases, fact sheets, communication strategies, etc.

- ***The Superfund Community Tools Home Page.*** There are a number of information resources available on the EPA Web Site. Point your Web browser to http://www.epa.gov/superfund/action/community/index.htm to access the Superfund Community Tools Home Page.

Appendix B
Document Review

[This page intentionally left blank.]

Document Review

The following six sections provide examples of potential documents to be reviewed as part of a five-year review. Each section addresses a different aspect of the document review. Documents commonly reviewed are displayed in a table in each section. Every site is different, so it may be necessary to review additional documents, such as relevant Memoranda of Understanding, to fully understand the remedial actions at a site. The tables and text below should be used as a guide.

- Basis for the Response Action;
- Implementation of the Response;
- Operation and Maintenance;
- Remedy Performance;
- Legal Documentation; and
- Community Involvement.

Basis for the Response Action

Remedy decision documents, and Federal and State laws and regulations, provide the basis upon which the remedy was selected or modified. The documents in the table below identify the background and goals of the remedy and any changes in laws and regulations that may affect the remedy. Other sources of remedy decision information are the Remedial Investigation/Feasibility Study (RI/FS) Report, toxicological and chemical characteristics databases, and transcripts of public meetings.

Non-remedial responses have other types of documentation. For instance, removal actions frequently are documented through an Action Memorandum. You should adapt your review of those documents to the circumstances at your site.

Document	Purpose of Document	Use During the Five-Year Review
Decision Documents – RODs – ROD Amendments – Explanations of Significant Differences – Action Memoranda	– records remedial decision or other actions, and significant changes from the original remedy	– goals of the remedy – background information on the site – basis for action – cleanup levels and applicable or relevant and appropriate requirements (ARARs) – community concerns and preferences

Document	Purpose of Document	Use During the Five-Year Review
Federal Environmental Laws and Regulations	– statutory and regulatory requirements that may affect the judgement as to whether the remedy protects human health and the environment	– changes in standards identified as ARARs in the ROD that provide a basis for cleanup levels/protectiveness of the remedy (only ARARs related to protectiveness need be reviewed) – pertinent laws and regulations promulgated since the signing of the ROD that are potentially applicable or relevant and appropriate and that potentially bear on the protectiveness of the remedy
State Environmental Laws and Regulations	– statutory and regulatory requirements that may affect the judgement as to whether the remedy protects human health and the environment	– more stringent State environmental laws and regulations have the same standing under the National Contingency Plan (NCP) as Federal laws and regulations, and should be reviewed in the same manner when they may call into question whether the remedy protects human health and the environment (the State typically should perform this component of the review)

Implementation of the Response

Implementation documents furnish information about design assumptions, design plans or modifications, and documentation of the completion of construction at operable units (OUs) and the site. Design reports, plans, and specifications are other documents that provide further information.

Document	Purpose of Document	Use During the Five-Year Review
Remedial Action Reports (both interim and final)	– documents that for a single operable unit all construction activities are complete, the remedy is operational and functional, and that cleanup levels have been achieved – Interim Remedial Action Reports are used for long-term actions where cleanup levels have not yet been achieved	– detailed history and status of remedial actions
As-built drawings	– documents changes/modifications to the original design which occurred during the construction	– documentation of completed action and/or implemented remedy

Document	Purpose of Document	Use During the Five-Year Review
Close Out Reports (Preliminary and Final)	– the preliminary report documents that all physical construction for all operable units at a site is complete – the final report documents cleanup levels have been met	– background information and the status of the remedial actions at the site

Remedy Performance

Monitoring data, progress reports, and performance evaluation reports provide information that can be used to determine whether the remedial action continues to operate and function as designed (*e.g.*, extent of groundwater plume is well defined and update plume maps confirm containment), and has achieved, or is expected to achieve, cleanup levels. The data presented in these documents can also provide trend analysis which can be used to determine how well the remedy is performing and how long it will take to achieve remediation goals. These reports can also indicate whether monitoring activities are adequate to ensure the effectiveness of the remedy (*e.g.*, wells in locations that can show contaminant plume is contained and not migrating) and whether these activities are being conducted.

Document	Purpose of Document	Use During the Five-Year Review
Monitoring Information/Records/Progress Reports (information could include air sampling, groundwater monitoring data, survey/settlement monument records, and gas generation records data/performance evaluation)	– records monitoring data and other information, including contaminant levels – trend analysis – containment evaluation	– to check whether contaminant levels are within established criteria – whether cleanup levels will be achieved – (for containment remedies) contaminant plumes are being contained

Operation and Maintenance (O&M)

O&M documents describe the ongoing measures at a site to ensure the remedy remains protective. (Long-term response actions to restore groundwater and surface water during the remedial phase are referred to as “system operations” in this guidance. Although this section refers to O&M documents, similar documents should be reviewed to assess system operations.) They provide the structure for O&M at the site and confirm that O&M is proceeding as planned. O&M documents that may be helpful are the O&M Manual, O&M Plan, the O&M Contract, O&M and Occupational Safety and Health Administration (OSHA) Training Records, permits and service agreements, and access and security logs. Other types of O&M data to be reviewed include permit compliance data such as air or water discharge sampling results, facilities operation data such as treatment train operational records, gas monitoring and leachate collection data, maintenance records and logs, and O&M cost data. These data demonstrate the proper O&M of the remedy.

Document	Purpose of Document	Use During the Five-Year Review
O&M Manual	– contains technical information necessary to operate and maintain the remedy	– purpose and function of the equipment and systems which comprise the overall facility
O&M Reports	– documents O&M activities, data, and costs	– to check whether O&M is proceeding as planned
Discharge Permits and Deviations*	– notes contaminant levels for the discharge permits – notes contaminant levels for deviations	– to check whether the remedy is operating within design parameters

* Permits are not required for actions taken on site. Reviewer should focus on ensuring compliance with substantive requirements of otherwise permitted activities.

Legal Documentation

Legal documentation pertinent to the site may specify responsibilities for conducting remedial actions, implementing institutional and access controls, O&M activities, and performing elements of the five-year reviews.

Document	Purpose of Document	Use During the Five-Year Review
Enforcement Documents – Consent Decrees – Unilateral Administrative Orders – Administrative Orders on Consent	– commitments/ agreements regarding implementation and operation of the remedy, and conduct of studies – access agreements that are needed	– responsibilities of the PRP for conducting remedial activities at various stages of site cleanup – O&M requirements (when these documents are used to enforce the performance of O&M, they may incorporate O&M documents, such as the O&M Manual)
Institutional Controls (deed notices, easements, other conditions, covenants or restrictions on deeds, and groundwater and land use restriction documents)	– means to restrict the use of a parcel or an associated resource, such as groundwater	– status of institutional controls
Superfund State Contracts and Cooperative Agreements	– State assurance letters to conduct O&M – State authorities responsible for O&M – specific O&M requirements – agreements with Indian Tribes	– O&M implementation and reporting requirements – roles of different agencies
Interagency Agreements and Federal Facility Agreements	– responsibilities of other agencies	– O&M guidelines and rules in effect (sometimes other agencies adopt their own guidelines and rules, which must be consistent with those established by EPA)

Community Involvement

The Community Involvement Plan (CIP) may give you a better understanding of the history of community involvement, and of other activities at the site. In addition, the CIP may help you identify community members who would be valuable resources during the interview process.

Document	Purpose of Document	Use During the Five-Year Review
Community Involvement Plan	– site communication strategy that specifies outreach activities	– community concerns/issues and identification of appropriate community members for interviews

[This page intentionally left blank.]

Appendix C
Five-Year Review Interviews

[This page intentionally left blank.]

Five-Year Review Interviews

Information gathered from interviews during the site inspection may be key to understanding site status. Interviews should be conducted with various individuals or groups, including the operation and maintenance (O&M) site manager, O&M staff, local regulatory authorities and response agencies, community action groups or associations, site neighbors, and other stakeholders.

When conducting an interview, the interviewer should note the date of the interview, and the name, title, and affiliation of the person interviewed. The interviewer should also indicate whether the interview was conducted at the site, the office, or by phone. Written documentation of the interview should briefly summarize the discussion, address any problems or successes with the implementation of the remedy, and provide suggestions for future reference. Forms to use during interviews are provided at the end of this appendix.

The following tables provide lists of potential individuals to interview and the type of information which may be obtained during the interviews. The potential individuals to be interviewed are categorized by their ability to provide the following types of information:

- Background information;
- State and local considerations;
- Construction considerations; and
- Performance, Operation and maintenance problems.

All of these individuals may be contacted during the five-year review. In most cases interviewing only a few key individuals will provide sufficient information for the review.

Background Information

The individuals listed below may provide information concerning previous and current concerns about the site, influences that affected the remedy decision, and further clarification on decisions made during remedy selection.

Interview	Information Sought
Previous EPA Staff/Management	– staff members may offer insight and clarification on decisions made during remedy selection and implementation
Nearest Neighbors	– neighbors may provide insight into the enforcement of institutional controls, changes in land use, trespassing, and unusual or unexpected activity at the site

Interview	Information Sought
Community Representatives*	– members of the community may provide a broader view of site activities and issues than can be obtained during the site inspection

* Several types of individuals may be interviewed: residents/businesses adjacent to or on the site; residents/businesses within the path of migration; local civic leaders, local officials, Community Advisory Group (CAG), Technical Assistance Grant (TAG) group, and local environmental groups; and other audiences listed in the community profile in the Community Involvement Plan.

Some example interview questions are given below.

1. What is your overall impression of the project? (general sentiment)

2. What effects have site operations had on the surrounding community?

3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

5. Do you feel well informed about the site's activities and progress?

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

State and Local Considerations

State and local authorities may provide you with information about changes in State laws and regulations and present and prospective land uses and restrictions.

Interview	Information Sought
State Contacts (including those responsible for State water quality, hazardous waste, and environmental health issues)	– changes in State laws and regulations that may impact protectiveness – whether the site has been in compliance with permitting or reporting requirements – information on site activities, status, and issues
Local Authorities (such as police, emergency response or fire departments, and local environmental or planning offices)	– status of institutional controls, site access controls, new ordinances in place, changes in actual or projected land use, complaints being filed, and unusual activities at the site

Some example interview questions are given below.

1. What is your overall impression of the project? (general sentiment)

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

4. Do you feel well informed about the site's activities and progress?

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Construction Considerations

It is important for you to determine the status of construction at the site and to ensure that health and safety concerns are addressed.

Interview	Information Sought
Construction Contractor	– progress of project and changes in design due to field conditions – revisions to the O&M Manual, implementation of the Health and Safety Plan/Contingency Plan – insight into potential O&M problems
Construction Manager	– overview of all contractor construction activities at the site, health and safety issues, site protectiveness during construction, and the quality of the construction
Local Emergency Response Officials	– adequacy of contractor's Health and Safety Plan and the contractor's implementation of the Plan – adequacy of contractor's emergency response duties as outlined in the Contingency Plan or Emergency Response Plan of the Health and Safety Plan

Some example interview questions for remedial actions still under construction are given below.

1. What is your overall impression of the project? (general sentiment)

2. What is the current status of construction (*e.g.*, budget and schedule)?

3. Have any problems been encountered which required, or will require, changes to this remedial design or this ROD?

4. Have any problems or difficulties been encountered which have impacted construction progress or implementability?

5. Do you have any comments, suggestions, or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)?

Performance, Operation And Maintenance Problems

The following individuals may provide information to you regarding the performance of the remedy and status of O&M at the site so that the team can assess the progress of the implementation and effectiveness of the remedy, and any O&M problems.

Interview	Information Sought
O&M Manager/Operating Contractor	– O&M status of the remedy, compliance with permit and reporting requirements, and complaints filed – effectiveness of the O&M Plan – information about any potential causes for concern about the remedy – progress and performance of the remedy
O&M Staff	– effectiveness of the O&M Manual – information about any potential causes for concern about the remedy – Recommendations for adjusting the mode of operation or optimizing the operations protocol
Remedial Design/Remedial Action Consultant	– original concepts behind the O&M of the remedy – questions about remedial design parameters, expected performance and cost, and changes that have occurred during implementation

Some example interview questions are given below.

1. What is your overall impression of the project? (general sentiment)

2. Is the remedy functioning as expected? How well is the remedy performing?

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

4. Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

7. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

8. Do you have any comments, suggestions, or recommendations regarding the project?

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date

INTERVIEW RECORD

Site Name:		**EPA ID No.:**	
Subject:		**Time:**	**Date:**
Type: ☐ Telephone ☐ Visit ☐ Other **Location of Visit:**		☐ Incoming ☐ Outgoing	

Contact Made By:		
Name:	**Title:**	**Organization:**

Individual Contacted:		
Name:	**Title:**	**Organization:**
Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

Page 1 of ____

[This page intentionally left blank.]

Appendix D
Five-Year Review Site Inspection Checklist

[This page intentionally left blank.]

Five-Year Review Site Inspection Checklist

Purpose of the Checklist

The site inspection checklist provides a useful method for collecting important information during the site inspection portion of the five-year review. The checklist serves as a reminder of what information should to be gathered and provides the means of checking off information obtained and reviewed, or information not available or applicable. The checklist is divided into sections as follows:

I. Site Information
II. Interviews
III. On-site Documents & Records Verified
IV. O&M Costs
V. Access and Institutional Controls
VI. General Site Conditions
VII. Landfill Covers
VIII. Vertical Barrier Walls
IX. Groundwater/Surface Water Remedies
X. Other Remedies
XI. Overall Observations

Some data and information identified in the checklist may or may not be available at the site depending on how the site is managed. Sampling results, costs, and maintenance reports may be kept on site or may be kept in the offices of the contractor or at State offices. In cases where the information is not kept at the site, the item should not be checked as "not applicable," but rather it should be obtained from the office or agency where it is maintained. If this is known in advance, it may be possible to obtain the information before the site inspection.

This checklist was developed by EPA and the U.S. Army Corps of Engineers (USACE). It focuses on the two most common types of remedies that are subject to five-year reviews: landfill covers, and groundwater pump and treat remedies. Sections of the checklist are also provided for some other remedies. The sections on general site conditions would be applicable to a wider variety of remedies. The checklist should be modified to suit your needs when inspecting other types of remedies, as appropriate.

The checklist may be completed and attached to the Five-Year Review report to document site status. Please note that the checklist is not meant to be completely definitive or restrictive; additional information may be supplemented if the reviewer deems necessary. Also note that actual site conditions should be documented with photographs whenever possible.

Using the Checklist for Types of Remedies

The checklist has sections designed to capture information concerning the main types of remedies which are found at sites requiring five-year reviews. These remedies are landfill covers (Section VII of the checklist) and groundwater and surface water remedies (Section IX of the checklist). The primary elements and appurtenances for these remedies are listed in sections which can be checked off as the facility is inspected. The opportunity is also provided to note site conditions, write comments on the facilities, and attach any additional pertinent information. If a site includes remedies beyond these, such as soil vapor extraction or soil landfarming, the information should be gathered in a similar manner and attached to the checklist.

Considering Operation and Maintenance Costs

Unexpectedly widely varying or unexpectedly high O&M costs may be early indicators of remedy problems. For this reason, it is important to obtain a record of the original O&M cost estimate and of annual O&M costs during the years for which costs incurred are available. Section IV of the checklist provides a place for documenting annual costs and for commenting on unanticipated or unusually high O&M costs. A more detailed categorization of costs may be attached to the checklist if available. Examples of categories of O&M costs are listed below.

<u>Operating Labor</u> - This includes all wages, salaries, training, overhead, and fringe benefits associated with the labor needed for operation of the facilities and equipment associated with the remedial actions.

<u>Maintenance Equipment and Materials</u> - This includes the costs for equipment, parts, and other materials required to perform routine maintenance of facilities and equipment associated with a remedial action.

<u>Maintenance Labor</u> - This includes the costs for labor required to perform routine maintenance of facilities and for equipment associated with a remedial action.

<u>Auxiliary Materials and Energy</u> - This includes items such as chemicals and utilities which can include electricity, telephone, natural gas, water, and fuel. Auxiliary materials include other expendable materials such as chemicals used during plant operations.

<u>Purchased Services</u> - This includes items such as sampling costs, laboratory fees, and other professional services for which the need can be predicted.

<u>Administrative Costs</u> - This includes all costs associated with administration of O&M not included under other categories, such as labor overhead.

Insurance, Taxes and Licenses - This includes items such as liability and sudden and accidental insurance, real estate taxes on purchased land or right-of-way, licensing fees for certain technologies, and permit renewal and reporting costs.

Other Costs - This includes all other items which do not fit into any of the above categories.

[This page intentionally left blank.]

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

<table>
<tr><th colspan="2">I. SITE INFORMATION</th></tr>
<tr><td>Site name:</td><td>Date of inspection:</td></tr>
<tr><td>Location and Region:</td><td>EPA ID:</td></tr>
<tr><td>Agency, office, or company leading the five-year review:</td><td>Weather/temperature:</td></tr>
<tr><td colspan="2">Remedy Includes: (Check all that apply)
☐ Landfill cover/containment ☐ Monitored natural attenuation
☐ Access controls ☐ Groundwater containment
☐ Institutional controls ☐ Vertical barrier walls
☐ Groundwater pump and treatment
☐ Surface water collection and treatment
☐ Other____________________________________
____</td></tr>
<tr><td colspan="2">Attachments: ☐ Inspection team roster attached ☐ Site map attached</td></tr>
<tr><th colspan="2">II. INTERVIEWS (Check all that apply)</th></tr>
<tr><td colspan="2">1. O&M site manager ______________________ ______________________ __________
Name Title Date
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. __________
Problems, suggestions; ☐ Report attached ______________________________________
____</td></tr>
<tr><td colspan="2">2. O&M staff ______________________ ______________________ __________
Name Title Date
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. __________
Problems, suggestions; ☐ Report attached ______________________________________
____</td></tr>
</table>

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________________
Contact ______________________________ ___________________ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ____
____

Agency ______________________________
Contact ______________________________ ___________________ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ____
____

Agency ______________________________
Contact ______________________________ ___________________ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ____
____

Agency ______________________________
Contact ______________________________ ___________________ ________ ____________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ____
____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents** ☐ O&M manual ☐ As-built drawings ☐ Maintenance logs Remarks__________	 ☐ Readily available ☐ Readily available ☐ Readily available	 ☐ Up to date ☐ Up to date ☐ Up to date	 ☐ N/A ☐ N/A ☐ N/A
2.	**Site-Specific Health and Safety Plan** ☐ Contingency plan/emergency response plan Remarks__________	☐ Readily available ☐ Readily available	☐ Up to date ☐ Up to date	☐ N/A ☐ N/A
3.	**O&M and OSHA Training Records** Remarks__________	☐ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements** ☐ Air discharge permit ☐ Effluent discharge ☐ Waste disposal, POTW ☐ Other permits__________ Remarks__________	 ☐ Readily available ☐ Readily available ☐ Readily available ☐ Readily available	 ☐ Up to date ☐ Up to date ☐ Up to date ☐ Up to date	 ☐ N/A ☐ N/A ☐ N/A ☐ N/A
5.	**Gas Generation Records** Remarks__________	☐ Readily available	☐ Up to date	☐ N/A
6.	**Settlement Monument Records** Remarks__________	☐ Readily available	☐ Up to date	☐ N/A
7.	**Groundwater Monitoring Records** Remarks__________	☐ Readily available	☐ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks__________	☐ Readily available	☐ Up to date	☐ N/A
9.	**Discharge Compliance Records** ☐ Air ☐ Water (effluent) Remarks__________	 ☐ Readily available ☐ Readily available	 ☐ Up to date ☐ Up to date	 ☐ N/A ☐ N/A
10.	**Daily Access/Security Logs** Remarks__________	☐ Readily available	☐ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other____

2. **O&M Cost Records**
☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate____________________ ☐ Breakdown attached

Total annual cost by year for review period if available

From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________ (Total cost)	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: ____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
Remarks____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ___
Frequency ___
Responsible party/agency ___
Contact ___ ___ ___ ___
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks___

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
Remarks___

2. **Land use changes on site** ☐ N/A
Remarks___

3. **Land use changes off site** ☐ N/A
Remarks___

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks___

B. Other Site Conditions

Remarks____
____
____
____
____
____

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent______________ Depth____________
Remarks____
____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
Lengths____________ Widths___________ Depths__________
Remarks____
____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent______________ Depth____________
Remarks____
____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
Areal extent______________ Depth____________
Remarks____
____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks____
____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks____
____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
Areal extent______________ Height____________
Remarks____
____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent______________
☐ Ponding ☐ Location shown on site map Areal extent______________
☐ Seeps ☐ Location shown on site map Areal extent______________
☐ Soft subgrade ☐ Location shown on site map Areal extent______________
Remarks____
____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent______________
Remarks____
____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks____
____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks____
____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks____
____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent______________ Depth____________
Remarks____
____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_______________ Areal extent_____________
Remarks____
____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent______________ Depth____________
Remarks____
____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent______________ Depth____________
Remarks____
____

5. **Obstructions** Type_____________________ ☐ No obstructions
☐ Location shown on site map Areal extent______________
Size____________
Remarks____
____

6. **Excessive Vegetative Growth** Type____________________
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent______________
Remarks____
____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks____
____

2. **Gas Monitoring Probes**
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____
____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____
____

4. **Leachate Extraction Wells**
☐ Properly secured/locked☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____
____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks____
____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks____
____

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks____
____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☐ N/A
Remarks____
____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
Remarks____
____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
Remarks____
____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent______________ Depth____________ ☐ N/A
☐ Siltation not evident
Remarks____
____

2. **Erosion** Areal extent______________ Depth____________
☐ Erosion not evident
Remarks____
____

3. **Outlet Works** ☐ Functioning ☐ N/A
Remarks____
____

4. **Dam** ☐ Functioning ☐ N/A
Remarks____
____

H. Retaining Walls	☐ Applicable	☐ N/A	
1.	**Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____________ Vertical displacement________________ Rotational displacement_____________ Remarks____ ____		
2.	**Degradation** ☐ Location shown on site map ☐ Degradation not evident Remarks____ ____		
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☐ N/A	
1.	**Siltation** ☐ Location shown on site map ☐ Siltation not evident Areal extent_______________ Depth_____________ Remarks____ ____		
2.	**Vegetative Growth** ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent_______________ Type_____________ Remarks____ ____		
3.	**Erosion** ☐ Location shown on site map ☐ Erosion not evident Areal extent_______________ Depth_____________ Remarks____ ____		
4.	**Discharge Structure** ☐ Functioning ☐ N/A Remarks____ ____		
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☐ N/A	
1.	**Settlement** ☐ Location shown on site map ☐ Settlement not evident Areal extent_______________ Depth_____________ Remarks____ ____		
2.	**Performance Monitoring** Type of monitoring____________________________ ☐ Performance not monitored Frequency_________________________________ ☐ Evidence of breaching Head differential___________________________ Remarks____ ____		

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks____
____
____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks____
____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks____
____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks____
____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks____
____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks____
____

C. Treatment System ☐ Applicable ☐ N/A	
1.	**Treatment Train** (Check components that apply) ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters_______________ ☐ Additive (*e.g.*, chelation agent, flocculent)_______________ ☐ Others_______________ ☐ Good condition ☐ Needs Maintenance ☐ Sampling ports properly marked and functional ☐ Sampling/maintenance log displayed and up to date ☐ Equipment properly identified ☐ Quantity of groundwater treated annually_______________ ☐ Quantity of surface water treated annually_______________ Remarks_______________
2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A ☐ Good condition ☐ Needs Maintenance Remarks_______________
3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks_______________
4.	**Discharge Structure and Appurtenances** ☐ N/A ☐ Good condition ☐ Needs Maintenance Remarks_______________
5.	**Treatment Building(s)** ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks_______________
6.	**Monitoring Wells** (pump and treatment remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_______________
D. Monitoring Data	
1.	Monitoring Data ☐ Is routinely submitted on time ☐ Is of acceptable quality
2.	Monitoring data suggests: ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks____
____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

____
____
____
____
____
____
____
____
____
____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

____
____
____
____
____
____
____
____
____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. ____ ____ ____ ____ ____ ____ ____ ____ ____
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. ____ ____ ____ ____ ____ ____ ____ ____ ____

Appendix E
Five-Year Review Report Template

[This page intentionally left blank.]

Five-Year Review Report Template

This appendix provides a suggested checklist and a format for Five-Year Review reports. The checklist appears first, followed by the report template. You are encouraged to follow the template to ensure national consistency in the structure of Five-Year Review reports. However, each report should take into account site-specific circumstances, and you should modify the report format and content accordingly. For example, in some cases the report may be clearer if organized by operable unit (OU), or you may need to include site-specific questions that do not appear in this appendix.

The suggested format for Five-Year Review reports includes three main components: cover material, summary information, and the report body. Templates for each of these components follow. These templates provide suggested standard formats, boilerplate text, subheadings, checklists, example tables, and protectiveness statements. Suggested boilerplate text is presented in text boxes. Within the boilerplate section, text enclosed in brackets ("[ ]") should be added as appropriate, and *italicized* text denotes discussions that the reviewer should add.

You should use both the checklist and report template as guides for the types of information that should appear in the different sections of your Five-Year Review report. You should include information that is relevant to your site and needed to ensure that the rationale behind the protectiveness determination is adequately documented.

[This page intentionally left blank.]

Content Checklist For
Five-Year Review Reports

This checklist may be used by you, your managers, etc., to verify that you have included all of the appropriate information in your Five-Year Review report. Depending on site-specific circumstances, some items may not be applicable. For example, a report for a site just beginning construction will generally contain less data than for a site that has reached construction completion.

General Report Format

- ☐ Signed concurrence memorandum (as appropriate)
- ☐ Title page with signature and date
- ☐ Completed five-year review summary form (page E-15)
- ☐ List of documents reviewed
- ☐ Site maps (as appropriate)
- ☐ List of tables and figures
- ☐ Interview report (as appropriate)
- ☐ Site inspection checklist
- ☐ Photos documenting site conditions (as appropriate)

Introduction

- ☐ The purpose of the five-year review
- ☐ Authority for conducting the five-year review
- ☐ Who conducted the five-year review (lead agency) and when
  - ☐ Organizations providing analyses in support of the review (*e.g.*, the contractor supporting the lead agency)
  - ☐ Other review participants or support agencies
- ☐ Review number (*e.g.*, first, second)
- ☐ Trigger action and date
- ☐ Number, description, and status of all operable units at the site
- ☐ If review covers only part of a site, explain approach
  - ☐ Define which areas are covered in the five-year review
  - ☐ Summarize the status of other areas of the site that are not covered in the present five-year

Site Chronology

- ☐ List all important site events and relevant dates (*e.g.*, date of initial discovery of problem, dates of pre-NPL responses, date of NPL listing, etc.)

Background

- ☐ General site description (*e.g.*, size, topography, and geology)
- ☐ Former, current, and future land use(s) of the site and surrounding areas
- ☐ History of contamination
- ☐ Initial response (*e.g.*, removals)
- ☐ Basis for taking remedial action (*e.g.*, contaminants)

Remedial Actions

- ☐ Regulatory actions (*e.g.*, date and description of Records of Decision, Explanations of Significant Difference, Administrative Orders on Consent, Consent Decrees and Action Memorandum)
- ☐ Remedial action objectives
- ☐ Remedy description
- ☐ Remedy implementation (*e.g.*, status, history, enforcement actions, performance)
- ☐ Systems operations/Operations & Maintenance
  - ☐ Systems operations/O&M requirements
  - ☐ Systems operations/O&M operational summary (*e.g.*, history, modifications, problems, and successes)
  - ☐ Summary of costs of system operations/O&M effectiveness (*i.e.*, are requirements being met and are activities effective in maintaining the remedy?)

Progress Since Last Five-Year Review (if applicable)

- ☐ Protectiveness statements from last review
- ☐ Status of recommendations and follow-up actions from last review
- ☐ Results of implemented actions, including whether they achieved the intended effect
- ☐ Status of any other prior issues

Five-Year Review Process

- ☐ Administrative Components
  - ☐ Notification of potentially interested parties of initiation of review process
  - ☐ Identification of five-year review team members (as appropriate)
  - ☐ Outline of components and schedule of your five-year review
- ☐ Community Involvement
  - ☐ Community notification (prior and post review)
  - ☐ Other community involvement activities (*e.g.*, notices, fact sheets, etc., as appropriate)
- ☐ Document review
- ☐ Data review
- ☐ Site inspection
  - ☐ Inspection date
  - ☐ Inspection participants

Five-Year Review Process, cont'd.

  - ☐ Site inspection scope and procedures
  - ☐ Site inspection results, conclusions
  - ☐ Inspection checklist
- ☐ Interviews
  - ☐ Interview date(s) and location(s)
  - ☐ Interview participants (name, title, etc.)
  - ☐ Interview documentation
  - ☐ Interview summary

Technical Assessment

- ☐ Answer Question A: Is the remedy functioning as intended by the decision documents?
  - ☐ remedial action performance (*i.e.*, is the remedy operating as designed?)
  - ☐ system operations/O&M
  - ☐ cost of system operations/O&M
  - ☐ opportunities for optimization
  - ☐ early indicators of potential issues
  - ☐ implementation of institutional controls and other measures

- ☐ Answer Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
  - ☐ changes in standards, newly promulgated standards, TBCs
  - ☐ expected progress towards meeting RAOs
  - ☐ changes in exposure pathways
  - ☐ changes in land use
  - ☐ new contaminants and/or contaminant sources
  - ☐ remedy byproducts
  - ☐ changes in toxicity and other contaminant characteristics
  - ☐ risk recalculation/assessment (as applicable)

- ☐ Answer Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
  - ☐ new or previously unidentified ecological risks
  - ☐ natural disaster impacts
  - ☐ any other information that could call into question the protectiveness of the remedy
- ☐ Technical Assessment Summary

Issues

- ☐ Issues identified during the technical assessment and other five-year review activities
- ☐ Determination of whether issues affect current or future protectiveness

Issues, cont'd.

- ☐ A discussion of unresolved issues raised by support agencies and the community (States, Tribes, other Federal agencies, local governments, citizens, PRPs, other interested parties), if applicable

Recommendations and Follow-up Actions

- ☐ Required/suggested improvements to identified issues or to current site operations
- ☐ Note parties responsible for actions
- ☐ Note agency with oversight authority
- ☐ Schedule for completion of actions related to resolution of issues

Protectiveness Statements

- ☐ Protective statement(s) for each OU (If the remedy is not protective of human health and/or the environment, have you provided supporting discussion and information in the report to make this determination, such as current threats or level of risk?)
- ☐ Comprehensive protectiveness statement covering all of the remedies at the site (if applicable)

Next Review

- ☐ Expected date of next review
- ☐ If five-year reviews will no longer be done, provide a summary of that portion of the technical analysis presented in the report that provides the rationale for discontinuation of five-year reviews

Five-Year Review Report

(First, Second, etc.) Five-Year Review Report

for

Site Name

City

County, State

Month, Year

PREPARED BY:

Lead Agency
Name and
Location

Approved by: Date:

______________________________ ______________________________

[Name]
[Title]
[Affiliation]

[This page intentionally left blank.]

Five-Year Review Report

The following Table of Contents notes typical major divisions and subheadings for Five-Year Review reports. Subheadings can be included as appropriate for a given review report. This is only a general example.

Table of Contents

Tables

Attachments

Appendix

List of Acronyms

You should include a list of acronyms used in the report here.

[This page intentionally left blank.]

Executive Summary

You should include an Executive Summary at the beginning of the report. The Executive Summary should be brief, and should include a reiteration of the protectiveness statements included in Section X of the Five-Year Review report.

[This page intentionally left blank.]

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*:		
EPA ID *(from WasteLAN)*:		
Region:	**State:**	**City/County:**

SITE STATUS	
NPL status: ☐ Final ☐ Deleted ☐ Other (specify) ____________	
Remediation status (choose all that apply): ☐ Under Construction ☐ Operating ☐ Complete	
Multiple OUs?* ☐ YES ☐ NO	**Construction completion date:** ___ / ___ / ______
Has site been put into reuse? ☐ YES ☐ NO	

REVIEW STATUS	
Lead agency: ☐ EPA ☐ State ☐ Tribe ☐ Other Federal Agency ____________	
Author name:	
Author title:	**Author affiliation:**
Review period:** ___ / ___ / ______ to ___ / ___ / ______	
Date(s) of site inspection: ___ / ___ / ______	
Type of review: ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion	
Review number: ☐ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) ____________	
Triggering action: ☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#____ ☐ Construction Completion ☐ Previous Five-Year Review Report ☐ Other (specify) ____________	
Triggering action date *(from WasteLAN)*: ___ / ___ / ______	
Due date *(five years after triggering action date)*: ___ / ___ / ______	

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

Summarize issues (see Chapter 3).

Recommendations and Follow-up Actions:

Summarize recommendations and follow-up actions (see Chapter 3).

Protectiveness Statement(s):

Include individual operable unit protectiveness statements. For sites that have reached construction completion and have more than one OU, include an additional and comprehensive protectiveness statement covering all of the remedies at the site (see Chapter 4).

Other Comments:

Make any other comments here.

Five-Year Review Report

I. Introduction

Provide a synopsis of "who, what, where, when, and why." Detail the following:

- *The purpose of the review;*
- *The authority for conducting the five-year review;*
- *Who conducted the review, when, and for what site or portion of the site;*
- *Whether it is the first review or a subsequent review at the site;*
- *What action triggered the review; and*
- *A brief status of areas of a site not addressed in the current review and/or the status of five-year reviews for other areas of the entire site.*

Further explanation and boilerplate text are provided below. Additional explanation on the following topics is provided in Chapter 1.

<u>The Purpose of the Review</u>

State the purpose of the five-year review specific to the site or portion of the site addressed in the review.

> The purpose of five-year reviews is to determine whether the remedy at a site [is/is expected to be] protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

<u>Authority for Conducting the Five-Year Review</u>

> The Agency is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:
>
> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104]*

> *or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*
>
> The agency interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR §300.430(f)(4)(ii) states:
>
> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Who Conducted the Five-Year Review

If the U.S. Army Corps of Engineers (USACE) or a contractor has conducted an analysis in support of a five-year review, you should include their name and the date of the analysis. When a contractor for a potentially responsible party (PRP) conducts analyses or provides information in support of a five-year review, you should identify the a contractor and their affiliation with the PRP in the Five-Year Review report. You should also identify who conducted the site inspection.

Boilerplate text for the explanation of who conducted the review is provided in the box below. This text is written as though EPA is the lead agency and should be adapted when another agency or department serves as the lead agency.

> The United States Environmental Protection Agency (EPA) Region [number] has conducted a five-year review of the remedial actions implemented at the [name] site in [location]. This review was conducted from [month, year] through [month, year]. This report documents the results of the review. [Please identify any party providing an analysis in support of the five-year review; also indicate the contractual arrangements under which this was done.]

Other Review Characteristics

State whether the review is the first or a subsequent five-year review for the site, what action or event "triggered" the review, and the date of this action. See Chapter 1, Section 1.2 of this guidance for a discussion of triggering events for the five-year review and indicate in your report whether the trigger for the current five-year review has been met.

Boilerplate text for the explanation of other review characteristics is provided in the box below. Select text from brackets as appropriate.

This is the [first/second/etc.] five-year review for the [name] site. The triggering action for this review is the date of the [triggering action], as shown in EPA's WasteLAN database: [date]. [This discussion should also mention what is specifically activating the review, *i.e.*, that hazardous substances, pollutants, or contaminants are or will be left on site above levels that allow for unlimited use and unrestricted exposure.]

In addition, if separate five-year reviews are conducted for different areas of a site, you should include the following in this section:

- *An explanation of this approach;*
- *A description of which areas are covered by this five-year review; and*
- *A brief synopsis of the remedial activities and the status of remedial measures and/or five-year reviews for other areas.*

II. Site Chronology

List all important site events and relevant dates in the site chronology, such as those shown in Table 1. The identified events are illustrative, not comprehensive.

Table 1: Chronology of Site Events

Event	Date
Initial discovery of problem or contamination	
Pre-NPL responses	
NPL listing	
Removal actions	
Remedial Investigation/Feasibility Study complete	
ROD signature	
ROD Amendments or ESDs	
Enforcement documents (CD, AOC, Unilateral Administrative Order)	
Remedial design start	
Remedial design complete	

Table 1: Chronology of Site Events

Event	Date
Superfund State Contract, Cooperative Agreement, or Federal Facility Agreement signature	
Actual remedial action start	
Construction dates (start, finish)	
Construction completion date	
Final Close-out Report	
Deletion from NPL	
Previous five-year reviews	

III. Background

Describe the fundamental aspects of the site, providing a clear, succinct description of site characteristics. The purpose of this section is to identify the threat posed to the public and environment at the time of the ROD, so that the performance of the remedy can be easily compared with the site conditions the remedy was intended to address. Include all major site activities prior to the signing of the ROD. In addition to text, you may use site maps to help clarify the discussion. The following checklist may assist you in developing the text for this section.

	Background Checklist
Physical Characteristics *Present the site's location and characteristics, including the following:*	
	Area of site, relation to parcel(s), extent and location of sources
	Whether site is located in a populated area or is near populated areas
	Whether site is located in an environmentally sensitive area or is near environmentally sensitive areas, where applicable
Land and Resource Use *Discuss the following:*	
	Former, current and projected land uses for the site, as identified in the ROD or other decision document
	Current and projected land uses for the area surrounding the site, at the time of the five-year review
	Human and ecological past, present and known future use of resources (*e.g.*, groundwater or surface water as a drinking water supply) and any other current uses of the site not already addressed, as applicable

	Background Checklist
History of Contamination *Discuss the following:*	
	The historical activities that caused contamination, including the type of activity or process, when it took place, the specific type of hazardous substances, and their volumes/proportions, if known
	How contamination was discovered and problems resulting from contamination
Initial Response *Describe any pre-ROD cleanup activities at the site:*	
	CERCLA removal actions, non-CERCLA removals/responses, closures, the ceasing of operations, as well as governing agreements and parties involved in these activities
Basis for Taking Action *Describe the contaminants found at the site by appropriate media type (soil, groundwater, surface water, air). Note the effect or potential effect of the contamination on people, resources they use, or the environment. Examples of elements of this discussion include the following:*	
	Contaminated media and structures (summary of remedial investigation)
	Resources/targets that have been or could potentially be affected, results of risk assessments, determination of primary health threat

IV. Remedial Actions

Discuss initial plans, implementation history, and current status of the remedy. Explain events identified in the chronology, and generally include discussions of remedy selection, remedy implementation, remedy performance, and system operations/O&M. Present – accurately, adequately, and concisely – relevant site activities from the signing of the ROD to the present. You should delineate all remedial measures, for instance, include monitoring, fencing, and institutional controls. Discuss any changes to or problems with remedial components. The following checklist may assist you in developing the text for this section.

	Remedial Actions Checklist
Remedy Selection *Describe the remedial action objectives and the selected remedy. This discussion should explain the following:*	
	Scope and role of actions including definition of OUs related to each ROD and how they relate to each other
	Source documents listing remedial action objectives and the remedy (*e.g.*, RODs, ESDs), including signature/filing date
	Statement of remedial action objectives, related to each OU or ROD
	Description of remedial actions/remedy, related to each OU or ROD, noting media addressed; all components of the remedy, including engineering controls, access controls, institutional controls, cleanup measures, treatment types, and required monitoring should be described

	Remedial Actions Checklist
Remedy Implementation *Discuss the history of and plans for implementation of the remedy. Discuss enforcement actions if applicable. The text may be presented either chronologically or by OU, and should include the following:*	
	Dates when remedial designs were started and completed
	Difficulties or changes that occurred during remedial design
	Dates when remedial actions were started and completed
	The performance of each remedial action since implementation
	Enforcement agreements, and parties involved in these agreements
	CERCLA removal actions or non-CERCLA removals/responses since the ROD
System Operations/O&M *Describe system operations/O&M requirements, activities to date, any problems that have arisen, and costs:*	
	System operations/O&M requirements, as noted in the system operations/O&M plan, system operations/O&M manual, enforcement documents, and monitoring plans
	System operations/O&M activities to date
	Problems in the implementation of system operations/O&M
	Originally estimated annual O&M costs
	Actual annual O&M costs over the review period
	Reasons for any unanticipated or unusually high O&M costs

A table, such as Table 2, should be used to document total annual system operations/O&M costs during the period preceding the current five-year review. In the text, you should discuss significant variations from anticipated costs or between operating years.

Table 2: Annual System Operations/O&M Costs

Dates		**Total Cost rounded to nearest $1,000**
From	**To**	

At the end of the remedial actions section, it is sometimes helpful for you to add a brief discussion of the current status of each of the components of the remedy. This discussion can be particularly helpful for large, complex sites.

V. Progress Since the Last Review

Progress since the last review should be discussed when follow-up actions which impact protectiveness were noted in the previous Five-Year Review report. The following checklist may assist you in developing the text for this section.

	Progress Since the Last Review Checklist
Describe progress toward accomplishing recommendations and follow-up actions since the last five-year review was completed. Include the following:	
	Protectiveness statements from the last review
	Status of recommendations and follow-up actions from last review
	Results of implemented actions, including whether they achieved the intended effect
	Status of any other prior issues

Table 3 below presents one approach for providing information on the recommendations and follow-up actions stated in the past review and subsequent actions. The accompanying text should also discuss why any recommendations and follow-up actions have not been implemented if that is the case, and whether implemented actions achieved desired results.

Table 3: Actions Taken Since the Last Five-Year Review

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action

VI. Five-Year Review Process

Describe activities performed during the five-year review process and provide a summary of findings when appropriate. The following checklist may assist you in developing the text for this section.

	Five-Year Review Process Checklist
Administrative Components of the Five-Year Review Process	
	Notify potentially interested parties of start of five-year review
	Identify members of the review team
	Develop a review schedule

	Five-Year Review Process Checklist
Community Notification and Involvement	
	Community notification
	Other community involvement activities
Document Review See Appendix B for a full discussion of the document review	
	What documents were reviewed
	Identify document source of RAOs, ARARs and cleanup levels
Data Review *Discuss and present the following:*	
	What data were reviewed
	Relevant trends and levels, noting levels which are not currently compliant and whether future compliance can be expected without additional action
	Tables summarizing monitoring and sampling data
	Increase and/or decrease or non-presence of specific chemical compounds and recommended changes for future monitoring programs
Site Inspection *Summarize the site inspection and site conditions:*	
	Date of site inspection (if more than one inspection was conducted to allow for monitoring or further inspection, list all inspections and activities conducted, and the reasons for conducting each inspection)
	Who conducted and/or attended the inspection
	Activities conducted (scope and procedures)
	Summary of site conditions, inspection results, conclusions
Interviews *Discuss the following:*	
	Interviews conducted (name, title, organization, date, location(S))
	Interview documentation
	Interview summary
	Successes/problems in the implementation of access and institutional controls
	Successes/problems with the construction of the remedy
	Successes/problems with system operations/O&M
	Unusual situations or problems at the site

VII. Technical Assessment

Discuss how each of the three questions asked in the technical assessment were answered (e.g., yes, yes, no or a variation of this) and provide the information that presents the basis for each answer as a framework for your protectiveness determination(s). Explain the conclusions of *your review, based on the information presented in the previous section. As explained in Chapter 4, the assessment should focus on answering three key questions:*

- *Question A: Is the remedy functioning as intended by the decision documents?*
- *Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?*
- *Question C: Has any other information come to light that could call into question the protectiveness of the remedy?*

Each question, and the associated information to be discussed, is presented in its own checklist which may assist you in developing the text for this section. Checklist items shown may be supplemented or modified based on site-specific circumstances.

	Checklist for Question A: Is the remedy functioning as intended by the decision documents?
Remedial Action Performance *Discuss the following:*	
	Whether the remedial action continues to be operating and functioning as designed
	Whether the remedial action is performing as expected and cleanup levels are being achieved
	Whether containment is effective
System Operations/O&M *Discuss the following:*	
	Whether operating procedures, as implemented, will maintain the effectiveness of response actions
	Whether large variances in O&M costs could indicate a potential remedy problems or remedy issues
Opportunities for Optimization *Discuss the following:*	
	Whether opportunities exist to improve the performance and/or reduce costs of monitoring, sampling, and treatment systems
Early Indicators of Potential Issues *Discuss the following:*	
	Whether frequent equipment breakdowns or changes indicate a potential issue
	Whether issues or problems could place protectiveness at risk
Implementation of Institutional Controls and Other Measures *Discuss the following:*	
	Whether access controls are in place and prevent exposure (*e.g.*, fencing and warning signs)
	Whether institutional controls are in place and prevent exposure
	Whether other actions (*e.g.*, removals) necessary to ensure that immediate threats have been addressed are complete

	Checklist for Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?
Changes in Standards and TBCs *Discuss the following:*	
	Whether standards identified in the ROD have been revised and call into question the protectiveness of the remedy
	Whether newly promulgated standards call into question the protectiveness of the remedy
	Whether TBCs used in selecting cleanup levels at the site have changed and could affect the protectiveness of the remedy
Changes in Exposure Pathways *Discuss the following:*	
	Whether land use or expected land use on or near the site changed
	Whether human health or ecological routes of exposure or receptors have been newly identified or changed in a way that could affect the protectiveness of the remedy
	Whether there are newly identified contaminants or contaminant sources
	Whether there are unanticipated toxic byproducts of the remedy not previously addressed by the decision documents
	Whether physical site conditions or the understanding of these conditions have changed in a way that could affect the protectiveness of the remedy
Changes in Toxicity and Other Contaminant Characteristics *Discuss the following:*	
	Whether toxicity factors for contaminants of concern at the site have changed in a way that could affect the protectiveness of the remedy
	Whether other contaminant characteristics have changed in a way that could affect the protectiveness of the remedy
Changes in Risk Assessment Methods *Discuss the following:*	
	Whether standardized risk assessment methodologies have changed in a way that could affect the protectiveness of the remedy
Expected Progress Towards Meeting RAOs	
	Whether the remedy is progressing as expected

When a standard or requirement has changed, a table can be used to record the nature of the change. Tables 4, 5, and 6 below demonstrate potential ways for you to note changes in chemical-specific, action-specific, or location-specific requirements, respectively.

Table 4: Changes in Chemical-Specific Standards

Contaminant	Media	Cleanup Level	Standard		Citation/Year
Chemical A	*e.g.*, groundwater	*e.g.*, 0.XX mg/L	Previous	*e.g.*, 0.XX mg/L	*e.g.*, SDWA 1988
			New	*e.g.*, 0.YY mg/L	*e.g.*, SDWA 1995
Chemical B			Previous		
			New		

Table 5: Changes in Action-Specific Requirements

Action	Requirement		Prerequisite	Citation/Year
Action A (*e.g.*, landfill)	Previous	Include original ARAR here; if none applies, state "None"		
	New			

Table 6: Changes in Location-Specific Requirements

Location	Requirement		Prerequisite	Citation/Year
Location A (*e.g.*, critical habitat upon which endangered or threatened species depend)	Previous	Include original ARAR here; if none applies, state "None"		
	New			

	Checklist for Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Other Information *Discuss the following:*	
	Whether newly identified ecological risks been found
	Whether there are impacts from natural disasters
	Whether any other information has come to light which could affect the protectiveness of the remedy

Technical Assessment Summary

Discuss how each of the three questions were answered and provide the information that presents the basis for each answer as a framework for your protectiveness determination(s).

VIII. Issues

Detail issues related to current site operations, conditions, or activities, noting which issue, if any, currently prevent the remedy from being protective. You may use a table such as Table 7 to note the issues identified.

Table 7: Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)

IX. Recommendations and Follow-up Actions

Specify the required and suggested improvements to current site operations, activities, remedy, or conditions. Note the parties responsible for actions, milestone dates, and which agencies have oversight authority. At a minimum, address all issues that currently affect current and/or future protectiveness. Table 8 illustrates one way to include the necessary information.

Table 8: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future

X. Protectiveness Statement(s)

Include a protectiveness statement for each OU at which a remedial action has begun. For sites that have reached construction completion and have more than one OU, you should develop and include an additional comprehensive site-wide protectiveness statement covering all of the remedies at the site. You should not include this additional protectiveness statement until construction completion because, until then, all remedies at the site have not necessarily been selected and constructed.

In order to promote consistency, you are strongly encouraged to model your protectiveness statements on the sample protectiveness statements provided in Chapter 4, Exhibits 4-6 and 4-7. Your Five-Year Review report should present the protectiveness statements at the beginning of a discussion that should explain and provide the supporting rationale of the protectiveness determination.

Suggested statements are as follows:

<u>If the remedial action at the OU is under construction, then use this statement</u>:

Protective or will be protective:

"The remedy at OU X is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."

Not protective:

"The remedy at OU X is not protective because of the following issues [describe the issue(s)]. The following actions need to be taken [describe the actions needed to ensure protectiveness]."

Protectiveness deferred:

"A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions [describe the actions]. It is expected that these actions will take approximately [insert time frame] to complete, at which time a protectiveness determination will be made."

<u>If the remedial action at the OU is operating or completed</u>:

Protective:

"The remedy at OU X is expected to be or is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."

Protective in the short-term:

"The remedy at OU X currently protects human health and the environment because [describe the elements of the remedy that protect human health and the environment in the short term]. However, in order for the remedy to be protective in the long-term, the following actions need to be taken [describe the actions needed to ensure long-term protectiveness]."

Not protective:

"The remedy at OU X is not protective because of the following issue(s) [describe the issue(s)]. The following actions need to be taken [describe the actions needed to ensure protectiveness].

Protectiveness deferred:

"A protectiveness determination of the remedy at OU X cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions [describe the actions]. It is expected that these actions will take approximately [insert time frame] to complete, at which time a protectiveness determination will be made."

<u>For Sites That Have Reached Construction Completion</u>:

If the remedy(s) is/are protective then use:

"Because the remedial actions at all OUs are protective, the site is protective of human health and the environment."

If the remedy is not protective then use:

"The remedial actions at OUs X and Y are protective. However, because the remedial action at OU Z is not protective, the site is not protective of human health and the environment at this time. The remedial action at OU Z is not protective because of the following issue(s) [describe the issue(s)]. The following actions need to be taken [describe the actions needed to ensure protectiveness]."

XI. Next Review

Discuss whether another five-year review will be conducted and the date on which that report will be due. If no additional five-year reviews are to be conducted, explain why and provide a justification for discontinuation of reviews.

Attachments

Site Maps (if not included in the body of the report)
List of Documents Reviewed
Tables and Figures Documenting Remedy Performance and Changes in Standards
(If not included in the body of the report)
Interview Report (as appropriate)
Photos Documenting Site Conditions

Appendix

Comments received from Support Agencies and/or the community

Appendix F
Sample Five-Year Review Report

[This page intentionally left blank.]

Five-Year Review Report

First Five-Year Review Report
for
Acme Superfund Site
Town of Riverside
Waters County, Massachusetts

September 2000

PREPARED BY:

United States Environmental Protection Agency
Region 1
Boston, Massachusetts

(This is a hypothetical site. However, the site characteristics were taken from an actual site in the Superfund program.)

Approved by: Date:

Robert Webster *September 11, 2000*

Robert Webster
Superfund Division Director
U.S. EPA, Region 1

[This page intentionally left blank.]

Table of Contents

Tables

Attachments

List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
CAMU	Corrective Action Management Unit
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	United States Environmental Protection Agency
CFR	Code of Federal Regulations
DEQE	Massachusetts Department of Environmental Quality Engineering
ESD	Explanation of Significant Difference
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRP	Potentially Responsible Party
PSD	Performing Settling Defendant
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SDWA	Safe Drinking Water Act
VOC	Volatile Organic Compound

[This page intentionally left blank.]

Executive Summary

The remedy for the Acme Superfund site in Riverside, Massachusetts included stabilization and capping of contaminated soils and sediments on site, institutional controls, and monitored natural attenuation of contaminated groundwater. The site achieved construction completion with the signing of the Preliminary Close Out Report on August 28, 1998. The trigger for this five-year review was the actual start of construction on September 12, 1995.

The assessment of this five-year review found that the remedy was constructed in accordance with the requirements of the Record of Decision (ROD). One Explanation of Significant Difference (ESD) was issued to change the cap design and the treatment approach of soils and sediments. The remedy is functioning as designed. The immediate threats have been addressed and the remedy is expected to be protective when groundwater cleanup goals are achieved through monitored natural attenuation, which is expected to require 10 years.

[This page intentionally left blank.]

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Acme Superfund Site		
EPA ID *(from WasteLAN)*: MADXXXXXXX		
Region: 1	**State:** MA	**City/County:** Riverside/Waters
SITE STATUS		
NPL status: ☒ Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction ☐ Operating ☒ Complete		
Multiple OUs?* ☐ YES ☒ NO	**Construction completion date:** 8 / 28 / 1998	
Has site been put into reuse? ☐ YES ☒ NO		
REVIEW STATUS		
Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency ______________		
Author name: Mary Jones		
Author title: Remedial Project Manager	**Author affiliation:** U.S. EPA, Region 1	
Review period:** 3 / 1 / 2000 to 8 / 31 / 2000		
Date(s) of site inspection: 3 / 12 / 2000 & 5 / 23 / 2000		
Type of review: ☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion)		
Review number: ☒ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify)		
Triggering action: ☐ Actual RA On-site Construction at OU #___ ☒ Actual RA Start at OU# NA ☐ Construction Completion ☐ Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date *(from WasteLAN)*: 9 / 12 / 1995		
Due date *(five years after triggering action date)*: 9 / 12 / 2000		

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

Burrowing animals were observed to have left minor tunnels in cap soil, and a portion of the constructed wetlands have not been properly maintained.

Failure to maintain a portion of the constructed wetlands due to restricted access to the property.

Inadequate monitoring to verify that the plume is not migrating.

Recommendations and Follow-up Actions:

The burrows are scheduled to be repaired. The State and Potentially Settling Defendants (PSDs) are actively seeking an alternate location for wetlands development.

Identify an alternate location for wetlands development.

Increase monitoring frequency for MW-103; Investigate groundwater discharge to river; sample sediments and groundwater at discharge points.

Protectiveness Statement(s):

All immediate threats at the site have been addressed, and the remedy is expected to be protective of human health and the environment after the groundwater cleanup goals are achieved through MNA in an estimated 10 years.

Long-term Protectiveness:

Long-term protectiveness of the remedial action will be verified by obtaining additional groundwater samples to fully evaluate potential migration of the contaminant plume downgradient from the treatment area and towards the river. Current data indicate that the plume remains on site. Additional sampling and analysis will be completed within the next six months. Current monitoring data indicate that the remedy is functioning as required to achieve groundwater cleanup goals.

Other Comments:

The problems encountered in maintaining the wetlands result from access issues that will be resolved once an alternative location for development of wetlands is identified. This issue does not impact protectiveness and is expected to be resolved within the current year.

Acme Superfund Site
Riverside, Massachusetts
First Five-Year Review Report

I. Introduction

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The United States Environmental Protection Agency (EPA), Region 1, conducted the five-year review of the remedy implemented at the Acme Superfund Site in Riverside, Massachusetts. This review was conducted by the Remedial Project Manager (RPM) for the entire site from March 2000 through August 2000. This report documents the results of the review.

This is the first five-year review for the Acme Site. The triggering action for this statutory review is the initiation of the remedial action on September 12, 1995. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

II. Site Chronology

Table 1 - Chronology of Site Events

Event	Date
Waste oil and solvent recovery activities at the site	1974 - 1978
Massachusetts Department of Environmental Quality Engineering (DEQE) (now Massachusetts Department of Environmental Protection or MADEP), initiates actions against facility owners resulting in closing of facility	1978
Removal activities - removing drums, liquids and sludge from tanks	1978 - 1984
Final listing on EPA National Priorities List	9/1983
Interim removal activities - Demolition and removal of remaining storage tanks and waste material contained in tanks	1986
Remedial Investigation/Feasibility Study (RI/FS) made available to public	1/1992
Proposed plan identifying EPA's preferred remedy presented to public; start of public comment period.	3/1992
ROD selecting the remedy is signed	9/30/1992
Consent Decree finalizing settlement for responsible party performance of remedy entered by Federal Court	9/18/1994
Start of on-site construction for building/structures demolition and decontamination (1st phase of site Remedial Action and date that triggers a five-year review).	9/12/1995
Completion of on-site construction for building/structures demolition and decontamination	12/28/1995
ESD issued by EPA, primarily changing soil and sediment stabilization from "in-situ" to "ex-situ", and changing cap design	11/26/1996
PRP Remedial Design approved by EPA	3/5/1997
Start of on-site construction for stabilization remedy (2nd phase of site Remedial Action)	3/11/1997
Pre-final inspection of Phase II remedial action	11/19/1997
Preliminary Close Out Report signed	8/28/1998
O & M Plan approved by EPA	9/18/1998

III. Background

Physical Characteristics

The Acme Site property includes a four-acre facility located on Canal Street adjacent to and upgradient of the Green River in Riverside, Massachusetts. Riverside is a community of approximately 12,000 residents, located in Waters County. In addition to the facility, the site includes the adjacent wetlands, wooded area, and the immediately adjacent portion of the river. The facility is located 200 feet northeast of the Green River and is within the river's 100-year flood zone. The site is bordered by Canal Street, wetlands and woodlands, the Green River, and a soccer field. Residential and commercial properties are located across Canal Street from the site (See Attachment 1).

Land and Resource Use

The historic land use of the site has involved some petroleum- or solvent-related industry since at least 1900. From at least 1974 until operations ceased in 1978, activities at the site included waste oil and solvent recovery and disposal. Since 1978, the facility has been inactive.

The current land use for the surrounding area is residential, commercial and recreational (the adjacent soccer field). The Green River is used for swimming and fishing. Although there have been a number of zoning changes over the years, it is anticipated that a mix of land uses similar to that described will continue into the future. In establishing cleanup requirements for the site, EPA considered the theoretical possibility of residential development at the site. The site itself is currently fenced and the treated, stabilized soils and sediments are contained within the fenced area under an impermeable cap.

The groundwater aquifer underlying the site is currently not used as a drinking water source. The dominant groundwater flow direction is to the southwest toward the Green River.

History of Contamination

The Acme facility reclaimed used oils and solvents from State collection points, treated them with a heat process, and sold them as lube oil and heavy fuel mixtures. In the course of these operations, spills occurred causing contamination of soils, sediments, and groundwater. Contamination in groundwater at the site consists primarily of volatile organic compounds (VOCs), including benzene and methylene chloride. Contaminants in soils and sediments include polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), VOCs, and other organics and lead. Contamination at the site was discovered in the course of several property inspections conducted by the State which documented improper maintenance, as well as waste oil and hazardous materials spills. Millions of gallons of waste were left behind in tanks and lagoons when the owner abandoned the facility in 1978.

Initial Response

From 1978 to 1984, as a result of State enforcement efforts, approximately 1.5 million gallons of waste material were removed from the site during a number of separate events. In 1982, the State requested assistance from EPA's Superfund program. EPA discovered several leaking tanks and contaminated ditches, as well as saturated soils. The site was proposed for the National Priorities List

(NPL) on December 30, 1982, and finalized on the NPL in March 1983. In 1986, interim measures were taken to establish complete fencing of the site, demolish and dispose of 19 storage tanks, dispose of the oil and water contained in the tanks, and dispose of sludge generated during the cleaning of tanks. In January 1992, the Remedial Investigation/Feasibility Study was made available to the public. In March 1992, the Proposal Plan identifying EPA's preferred remedy was presented to the public, starting the period for public comment.

Basis for Taking Action

Contaminants

Hazardous substances that have been released at the site in each media include:

Soil

PCBs
PAHs
1,1-Dichloroethane
Cis-1,2-Dichloroethylene
Trans-1,2-Dichloroethylene
1,1,1-Trichlorethane
Trichloroethylene
Tetrachloroethylene
Benzene
Lead

Lagoon Sediment

Bis (2-ethylhexyl) Phthalate
PAHs
1,1-Dichlorethane
1,1,1-Trichloroethane
Trichloroethylene
Tetrachloroethylene
Methylene Chloride
Benzene
Acetone
Lead

Groundwater

Bis (2-ethylhexyl) Phthalate
Vinyl Chloride
1,1-Dichloroethane
Cis-1,2-Dichloroethylene
Trans-1,2-Dichloroethylene
1,1,1-Trichlorethane
Methylene Chloride
Trichloroethylene
Tetrachloroethylene
Benzene
2-Butanone (MEK)
Acetone
Lead

Wetland Sediment

PCBs
PAHs
Arsenic
Lead
Zinc

Exposures to soil, groundwater, wetland sediment, and lagoon sediment are associated with significant human health risks, due to exceedance of EPA's risk management criteria for either the average or the reasonable maximum exposure scenarios. The carcinogenic risks were highest for exposures to lagoon sediments due to the high concentrations of carcinogenic polyaromatic hydrocarbons (PAHs). Non-carcinogenic hazards were highest for exposure to wetland sediment due to the high concentrations of lead detected in the medium. Risks from exposure to soil were significant due to the presence of TCE, PCE, and PCBs. Potential risks associated with exposure to groundwater are attributed to the presence of a variety of VOC contaminants that exist at concentrations that exceed State and Federal MCLs.

IV. Remedial Actions

Remedy Selection

The ROD for the Acme Site was signed on September 30, 1992. Remedial Action Objectives (RAOs) were developed as a result of data collected during the Remedial Investigation to aid in the development and screening of remedial alternatives to be considered for the ROD. The RAOs for Acme were divided into the following groups:

<u>Source Control Response Objectives</u>

- Minimize the migration of contaminants from the property soils and lagoon sediment that could degrade groundwater quality;

- Reduce risks to human health by preventing direct contact with, and ingestion of, contaminants in the property soils, wetland sediments, and lagoon sediments, and by preventing potential ingestion of contaminated groundwater;

- Reduce risks to the environment by preventing direct contact with, and ingestion of, contaminants in the wetland sediments; and

- Minimize the migration of contaminants (*i.e.*, from property soils, lagoon sediments, and wetland sediments) that could result in surface water concentrations in excess of Ambient Water Quality Criteria.

<u>Management of Migration Response Objectives</u>

- Eliminate or minimize the threat posed to human health and the environment by preventing exposure to groundwater contaminants;

- Prevent further migration of groundwater contamination beyond its current extent; and

- Restore contaminated groundwater to Federal and State applicable or relevant and appropriate requirements (ARARs), including drinking water standards, and to a level that is protective of human health and the environment within a reasonable period of time.

The major components of the source control remedy selected in the ROD include the following:

1. Decontamination, demolition, and off-site disposal of property structures; treatment and discharge of lagoon surface water;
2. Consolidation of contaminated property soils with lagoon and wetland sediments on site property;
3. In-situ mixing and stabilization of property soils/sediments with treatment agents to bind

contaminants into a stable matrix;
4. Construction of a permeable cap over stabilized property soils and sediments, and grading and planting of the cap's surface;
5. Restoration of wetlands;
6. Implementation of institutional controls on groundwater use and land development; and
7. Long-term monitoring of groundwater, wetland sediments, and Green River water and sediments.

The major components of the management of migration remedy selected in the ROD include:

1. Use of monitored natural attenuation (MNA) to achieve groundwater cleanup levels;
2. Groundwater monitoring of existing wells on the Acme property and of monitoring wells adjacent to the property;
3. Sediment sampling of portions of the wetland and the Green River, and where groundwater discharges to the wetland and the Green River;
4. Surface water sampling in areas adjacent to the wetland and in the Green River; and
5. Five-year site reviews to assess site conditions, contaminant distributions, and any associated site hazards.

An ESD was issued on November 26, 1996. Subsurface conditions including the existence of building foundations and low soil workability rendered in-situ stabilization impracticable. Additionally, Potentially Responsible Parties (PRPs) suggested adding a geosynthetic layer to the cap that would make it an impermeable cap rather than a soil cap. EPA approved the recommended change. The primary changes documented in the ESD were:

- Ex-situ stabilization instead of in-situ; and
- Construction of an impermeable cap instead of a permeable cap.

The change to ex-situ stabilization led to the necessity of designating a Corrective Action Management Unit (CAMU) at the site concurrent with the ESD. This designation allowed the handling and temporary storage of contaminated soils and sediments.

Institutional controls are required for the Acme property as well as for the adjacent Town-owned property, the only properties on or near the site requiring institutional controls. These institutional controls are established through the Access and Institutional Controls Agreement between the Performing Settling Defendants (PSDs) and the Town of Riverside, dated October 20, 1994, and recorded on June 19, 1997 in the Waters County Registry of Deeds.

Remedy Implementation

In a Consent Decree (CD) signed with EPA on September 18, 1994, 112 PSDs agreed to perform the remedial design/remedial action (RD/RA) and pay past costs for cleaning up the site. The Remedial Design (RD) was conducted in conformance with the ROD as modified by the ESD. The RD was approved by EPA on March 5, 1997.

The Remedial Action (RA) took place in two phases. The first phase entailed the decontamination, demolition and off-site disposal at a non-hazardous waste landfill of property structures. The activities for this phase were initiated on September 12, 1995 and were completed on December 28, 1995. The major components of this phase of the RA were the following:

- Decontamination of the buildings and structures on the property;
- Removal, treatment, and discharge to the Green River of water from the basement of one building and water collected from decontamination;
- Collection and analyses of composite samples of buildings and structures;
- Demolition and off-site disposal as non-hazardous waste of property buildings and structures and off-site disposal of miscellaneous debris from the property;
- Removal and off-site disposal of two underground storage tanks and their contents; and
- Restoration of demolition areas to match existing grade.

The second phase entailed all other remedial activities. Components 2 through 7 of the Source Control Remedy constituted the primary activities performed as the second phase of the RA. The activities for the second phase of the RA were formally initiated on March 11, 1997 when the PSDs awarded the RA contract. The contractor conducted remedial activities as planned and EPA and the State conducted a pre-final inspection on November 19, 1997. During this period, 1,606 cubic yards of lagoon sediment, 1,187 cubic yards of wetland sediment, and 8,000 cubic yards of soil were treated, stabilized, and placed under the impermeable cap. In addition, a fence with warning signs and surface water drainage structures were built. At this time, the preparation for the wetland restoration (grading and backfilling of clean sediment material) and the planting of new replacement wetland species was accomplished. The pre-final inspection concluded that construction had been completed in accordance with the remedial design plans and specifications and did not result in the development of a punch list.

The site achieved construction completion status when the Preliminary Close Out Report was signed on August 28, 1998.

EPA and the State have determined that all RA construction activities, including the implementation of institutional controls, were performed according to specifications. It is expected that cleanup levels for all groundwater contaminants will have been reached within approximately ten years. After groundwater cleanup levels have been met, EPA will issue a Final Close Out Report.

System Operation/Operation and Maintenance

The PSDs are conducting long-term monitoring and maintenance activities according to the operation and maintenance (O&M) plan that was approved by EPA on September 8, 1998. The primary activities associated with O&M include the following:

- Visual inspection of the cap with regard to vegetative cover, settlement, stability, and any need for corrective action. In addition, the cap is scheduled to be mowed semi-annually;
- Inspection of the drainage swale for blockage, erosion and instability, and any need for corrective action;

- Inspection of the condition of groundwater monitoring wells;

- Environmental monitoring: Quarterly monitoring of groundwater, wetland surface water and sediment, and Green River surface water and sediment; and

- Engineered wetlands inspection and assessment: Inspections are conducted primarily for the purposes of assessing both weed control needs and the survival of plantings. Assessments are performed specifically to determine if the engineered wetlands are meeting the performance standards regarding the survival and density of desired wetland species.

The primary cleanup of the Acme Site took place during the construction phase of the Remedial Action (*i.e.* the stabilization of contaminated soil and sediments). The other remaining component of cleanup is the natural attenuation of groundwater, as the source of groundwater contamination in soil and sediment has been removed. Therefore, as indicated in the planned elements above, the primary O&M activities have been geared towards monitoring groundwater, surface water, sediments, wetlands, inspections, and maintenance of the cap.

A currently evolving issue exists with regard to the engineered wetlands. The total area of engineered wetlands at the Acme Site is 0.7 acres. This area encompasses wetland habitats that were replanted with appropriate wetland plant species following the removal of contaminated sediments during the RA. As previously mentioned, there are performance standards with regard to density of desired plant species and to minimization of weeds and other undesirable species. The PSDs are obligated to meet these standards. During the course of the O&M period, there have been repeated access issues involving the property abutting the southern border of the Acme property. During the RA, contaminated sediments were removed from this property, clean sediment was backfilled, and wetland plants were planted. Since completion of the RA, the owner of this property has prevented PSD contractors from performing maintenance (weeding and replanting, as necessary) in an area that is highly at risk from invasive species. The area affected by this issue is 0.32 acres. EPA, the Riverside Conservation Commission, and the PSDs are working together to determine if there is additional wetland acreage at the site which may be amenable to restoration or enhancement. If an appropriate area is found, it may be substituted for the 0.32 acre area that is not accessible for maintenance. The failure to provide proper maintenance for the wetlands does not impact the protectiveness of the site.

O&M costs include cap and drainage structure maintenance, sampling and monitoring efforts, monitoring well maintenance, and wetlands maintenance. In the first year, costs were higher due to an extra effort required to establish the vegetative cover on the cap and to establish wetlands. Less effort was required the second year and the PSDs were denied access by a property owner and were not able to maintain all of the wetlands. Costs are expected to rise when additional wetlands are identified and developed. The O&M costs for the first two years are consistent with the originally estimated annual costs of $20,000 per year.

Table 2 - Annual System Operations/O&M Costs

Dates		Total Cost rounded to nearest $1,000
From	To	
9/1998	9/1999	$22,000.00
9/1999	9/2000	$17,000.00

V. Progress Since the Last Five-Year Review

This was the first five-year review for the site.

VI. Five-Year Review Process

Administrative Components

Members of the PSDs and the MADEP were notified of the initiation of the five-year review on February 1, 2000. The Acme Five-Year Review team was led by Mary Jones of EPA, Remedial Project Manager (RPM) for the Acme Site, and included members from the Regional Technical Advisory staff with expertise in hydrology, biology, and risk assessment. Tom McDuff of the State assisted in the review as the representative for the support agency.

From March 1 to March 15, 2000, the review team established the review schedule whose components included:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Local Interviews; and
- Five-Year Review Report Development and Review.

The schedule extended through August 31, 2000.

Community Involvement

Activities to involve the community in the five-year review were initiated with a meeting in early January 2000 between the RPM and the Community Involvement Coordinator (CIC) for the Acme Superfund site. A notice was sent to two local newspapers that a five-year review was to be conducted and that there would be a public meeting on April 20, 2000. A letter stating the same was sent to the Community Advisory Group (CAG), the Waters County Department of Health, the Fire and Rescue Department of Riverside, the County Commissioner's office, and the residents of properties adjacent to the Acme Superfund site. The letter invited the recipients to submit any comments to EPA.

During the public meeting, representatives of the CAG and local residents expressed concerns that work be completed as soon as possible at the site as they were concerned about the stigma that may be attached to the property in the future, limiting its availability for redevelopment. None of the attendees expressed any concerns over the protectiveness of the remedy.

On September 11, 2000, a notice was sent to the same local newspapers that announced that the Five-Year Review report for the Acme Superfund site was complete, and that the results of the review and the report were available to the public at the Riverside Town Library and the EPA Region 1 office.

Document Review

This five-year review consisted of a review of relevant documents including O&M records and monitoring data (See Attachment 3). Applicable groundwater cleanup standards, as listed in the 1992 Record of Decision, were reviewed (See Attachment 4).

Data Review

Groundwater Monitoring

Groundwater monitoring has been conducted at the Acme Site since the late 1980s. In general, most contaminants were detected at their highest levels early in the Removal/Remedial history of the site (1989 to 1990). This high level followed by a drop in contaminant levels may well have been the result of removal activities eliminating significant source material.

The evaluation of the natural attenuation processes at the site was achieved by evaluating four indicators that are recommended in the *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (OSWER Directive No. 9200.4-17P, April 21, 1999) for evaluating the performance of an MNA remedy. The four indicators are:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions that may reduce the efficacy of the natural attenuation processes;
- Identify any potentially toxic or mobile transformation products; and
- Verify that the plume is not expanding either downgradient, laterally, or vertically.

Since construction completion in 1997, 8 of the 13 contaminants for which groundwater cleanup levels have been established, remained below their respective cleanup goals in all sampling events. Furthermore, for the five contaminants that have exceeded their cleanup goals in recent sampling events, there is a marked trend downward in concentrations. Recent monitoring results for the five contaminants are shown in Table 3. MW-104b, MW-104c, and MW-105b are located on the southern end of the treatment area which is the downgradient side. Therefore, trends in contaminant levels in these wells are good indicators of the fate of contaminants remaining in the groundwater near to the original source areas. In MW-104b and MW-104c, there is a clear downward trend in benzene concentrations, although concentrations remain above the cleanup goals. There is a clear indication that concentrations of TCE and the daughter products, cis 1,2-DCE and vinyl chloride are trending downward in MW-105b and MW-104c. This monitoring record indicates that the groundwater attenuation process conceptualized in the ROD is proceeding essentially as expected.

Table 3 - Quarterly Comparison of Groundwater Concentrations

Contaminant	Well No.	MCL (ppb)	Concentration in ppb				
			3/1999	6/1999	9/1999	12/1999	3/2000
Benzene	104b	5	110*	130*	310 (est)*	120*	58*
Benzene	104c	5	2,300*	4,900*	530*	190*	39*
Benzene	103c	5	100*	130*	130*	100*	NS
Trichlorethene	105b	5	15 (est)*	5.5*	ND	0.29 (est)	0.014 (est)
Vinyl chloride	105b	2	13*	5.2*	ND	ND	5.9 (est)*
cis-1,2,-Dicloroethene	104c	70	ND	78*	7.4 (est)	5.8	0.88
Lead	104c	0.015	0.005 (est)	0.004 (est)	0.017*	ND	0.003 (est)

* = Exceeds Cleanup Level
(est) = Estimated Value
ND = Not Detected
NS = Not Sampled

No monitoring of environmental conditions that may affect the efficacy of the MNA remedy is being conducted at this time. Given that contaminant concentrations continue to decline, such monitoring may not be necessary, as attenuation processes appear to be functioning as expected.

No potentially toxic or mobile transformation products have been identified during sampling events that were not already present at the time of the ROD, and therefore have cleanup goals specified in the ROD.

Regarding plume migration, there is some concern that the plume may be migrating downgradient toward the Green River. Concentrations of benzene in MW-103c have remained relatively stable since March 1999, lacking the downward trend in concentrations for this contaminant seen in other wells. This well is located downgradient from the treatment area and is closest to the river. This may be an indication that the plume is being pulled toward the river. The lack of a sampling point for the March 2000 event, due to the area of the well being flooded, gives rise to further concern. In the future, if it is not possible to obtain a sample during a scheduled monitoring event, provisions have been made to return to the site at a later date to obtain the sample and ensure that the monitoring record is complete.

Surface Water and Sediment Monitoring

Quarterly analysis of surface water samples taken in areas adjacent to the wetland and in the Green River found that all levels of contaminants of concern were below detection. Analysis of sediment samples taken in portions of the wetland and the Green River where groundwater discharges to the surface found contaminant levels also below detection limits.

Site Inspection

Inspections at the site were conducted on March 12, and May 23, 2000, by the RPM and an EPA biologist (See Attachment 5). The purpose of the inspections was to assess the protectiveness of the remedy, including the presence of fencing to restrict access, the integrity of the cap and the condition of the restored wetlands. Institutional controls were evaluated by visiting the County Planning Office to review zoning maps and by visiting the County Department of Health to review information on the site. A visit to the County Office of Public Records to review the property deed confirmed that a deed covenant had been filed.

No significant issues have been identified at any time regarding the cap, the drainage structures, or the fence. Examination of the cap revealed that there had been some slight burrowing of small animals. Another minor issue was trespassing and its effect on plantings within restored wetlands. As noted, a joint effort between the governments and the PSDs is being made to potentially change some of the wetland areas which are subject to restoration. In addition, the use of additional fencing is being considered within the site property boundaries to inhibit trespassing and better protect restored wetland plantings.

The institutional controls that are in place include prohibitions on the use or disturbance of groundwater until cleanup levels are achieved, excavation activities, disturbance of the cap, and any other activities or actions that might interfere with the implemented remedy. No activities were observed that would have violated the institutional controls. The cap and the surrounding area were undisturbed, and no new uses of groundwater were observed.

Interviews

Interviews were conducted with various parties connected to the site. Marjorie Edwards, owner of nearby Pliny Products, was interviewed on June 17, 2000. Two nearby residents, Alice Parsons and Michael Smith, were interviewed on July 18, 2000. No significant problems regarding the site were identified during the interviews. However, Mr. Smith and Ms. Parsons did note that occasional passers by have walked through the site. Paul Wainwright, a representative of the Riverside Conservation Commission, was interviewed on July 18, 2000, and expressed concern that requirements for wetland mitigation were not being observed. Mr. Wainwright was, however, confident that the problem would be resolved when a parcel of neighboring land would be selected for the establishment of new wetlands. During the May inspection, EPA interviewed the staff of the Fire and Rescue Department of Riverside, MA. None of the staff were able to identify any concerns regarding the site and there had not been any emergency responses at the site since the end of remedial construction.

VII. Technical Assessment

<u>Question A: Is the remedy functioning as intended by the decision documents?</u>

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD, as modified by the ESD. The stabilization and capping of contaminated soils and sediments has achieved the remedial objectives to minimize the migration of contaminants to groundwater and surface water and prevent direct contact with, or ingestion of, contaminants in soil and sediments. The effective implementation of institutional controls has prevented exposure to, or ingestion of, contaminated groundwater.

Operation and maintenance of the cap and drainage structures has, on the whole, been effective. A few small areas showed evidence of burrowing of small animals. The burrows did not penetrate beyond the soil layer, and so did not affect protectiveness. The PSDs were arranging for filling of the burrows and will include the task of inspection and repair of small animal burrows in future O&M routines. O&M annual costs are consistent with original estimates and there are no indications of any difficulties with the remedy.

Where the PSDs have had access to wetlands, the maintenance of the wetlands has been good. A 0.32-acre portion of the wetlands has not been maintained because the property owner where the wetlands are located has denied access to the PSDs. EPA, the Riverside Conservation Commission, and the PSDs are currently working to identify an alternate location where wetlands can be developed. The failure to meet the wetlands mitigation requirements for the site does not affect the potential for release of contaminants and does not affect protectiveness for the site.

There were no opportunities for system optimization observed during this review. The monitoring well network provides sufficient data to assess the progress of natural attenuation within the plume, and maintenance on the cap is sufficient to maintain it's integrity. There is some concern that the plume may be migrating downgradient toward the Green River. Concentrations of benzene in MW-103c have remained relatively stable since March 1999, lacking the downward trend in concentrations for this contaminant seen in other wells. This well is located downgradient from the treatment area and is closest to the river. This may be an indication that the plume is being pulled toward the river. The lack of a sampling point for the March 2000 event, due to the area of the well being flooded, gives rise to further concern.

The institutional controls that are in place include prohibitions on the use or disturbance of groundwater until cleanup levels are achieved, and prohibitions on excavation activities, disturbance of the cap, and any other activities or actions that might interfere with the implemented remedy. No activities were observed that would have violated the institutional controls. The cap and the surrounding area were undisturbed, and no new uses of groundwater were observed. The fence around the site is intact and in good repair.

<u>Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?</u>

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

<u>Changes in Standards and To Be Considereds</u>

As the remedial work has been completed, most ARARs for soil contamination cited in the ROD have been met. ARARs that still must be met at this time and that have been evaluated include: the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels were derived - [Maximum Contaminant Levels (MCLs), and MCL Goals (MCLGs)]; ARARs related to wetland protection; and ARARs related to post-closure monitoring. A list of ARARs is included in Attachment 3. There have been no changes in these ARARs and no new standards or TBCs affecting the protectiveness of the remedy.

<u>Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics</u>

The exposure assumptions used to develop the Human Health Risk Assessment included both current exposures (older child trespasser, adult trespasser) and potential future exposures (young and older future child resident, future adult resident and future adult worker). There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. No change to these assumptions, or the cleanup levels developed from them is warranted. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. The remedy is progressing as expected and it is expected that all groundwater cleanup levels will be met within approximately 10 years.

<u>Question C: Has any other information come to light that could call into question the protectiveness of the remedy?</u>

No ecological targets were identified during the baseline risk assessment and none were identified during the five-year review, and therefore monitoring of ecological targets is not necessary. All sediment and surface water samples analyzed found no contamination of wetlands or surface water. No weather-related events have affected the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

<u>Technical Assessment Summary</u>

According to the data reviewed, the site inspection, and the interviews, the remedy is functioning as intended by the ROD, as modified by the ESD. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Most ARARs for soil contamination cited in the ROD have been met. There has been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment, and there have been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

VIII. Issues

Table 4 - Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Evidence of small animal burrows at a few locations on the southwest corner of the cap.	N	N

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Failure to maintain 0.32 acres of the total 0.7 acres of wetlands constructed to comply with wetlands mitigation requirements for the site.	N	N
Inadequate monitoring data to verify that the plume is not migrating	N	Y

IX. Recommendations and Follow-Up Actions

Table 5 - Recommendations and Follow-Up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Animal burrows in cap	Repair current burrows; establish O&M task to ensure future burrows are identified and repaired	PSDs	State/EPA	6/30/2001	N	N
0.32 acres of wetlands not maintained due to access problems	Identify alternate location at or near the site for wetlands development	PSD, Riverside Conservation Commission	State/EPA	9/30/2001	N	N
Inadequate monitoring data	1) Increase monitoring frequency for MW-103 cluster; 2) Investigate groundwater recharge to river; and 3) Sample sediments and groundwater flux at recharge points.	PSDs	State/EPA	9/30/2001	N	Y

X. Protectiveness Statement

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through natural attenuation, which is expected to require 10 years to achieve. In the interim, exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater. All threats at the site have been addressed through stabilization and capping of contaminated soil and sediments, the installation of fencing and warning signs, and the implementation of institutional controls.

Long-term protectiveness of the remedial action will be verified by obtaining additional groundwater samples to fully evaluate potential migration of the contaminant plume downgradient from the treatment area and towards the river. Current data indicate that the plume remains on site. Additional sampling and analysis will be completed within the next six months. Current monitoring data indicate that the remedy is functioning as required to achieve groundwater cleanup goals.

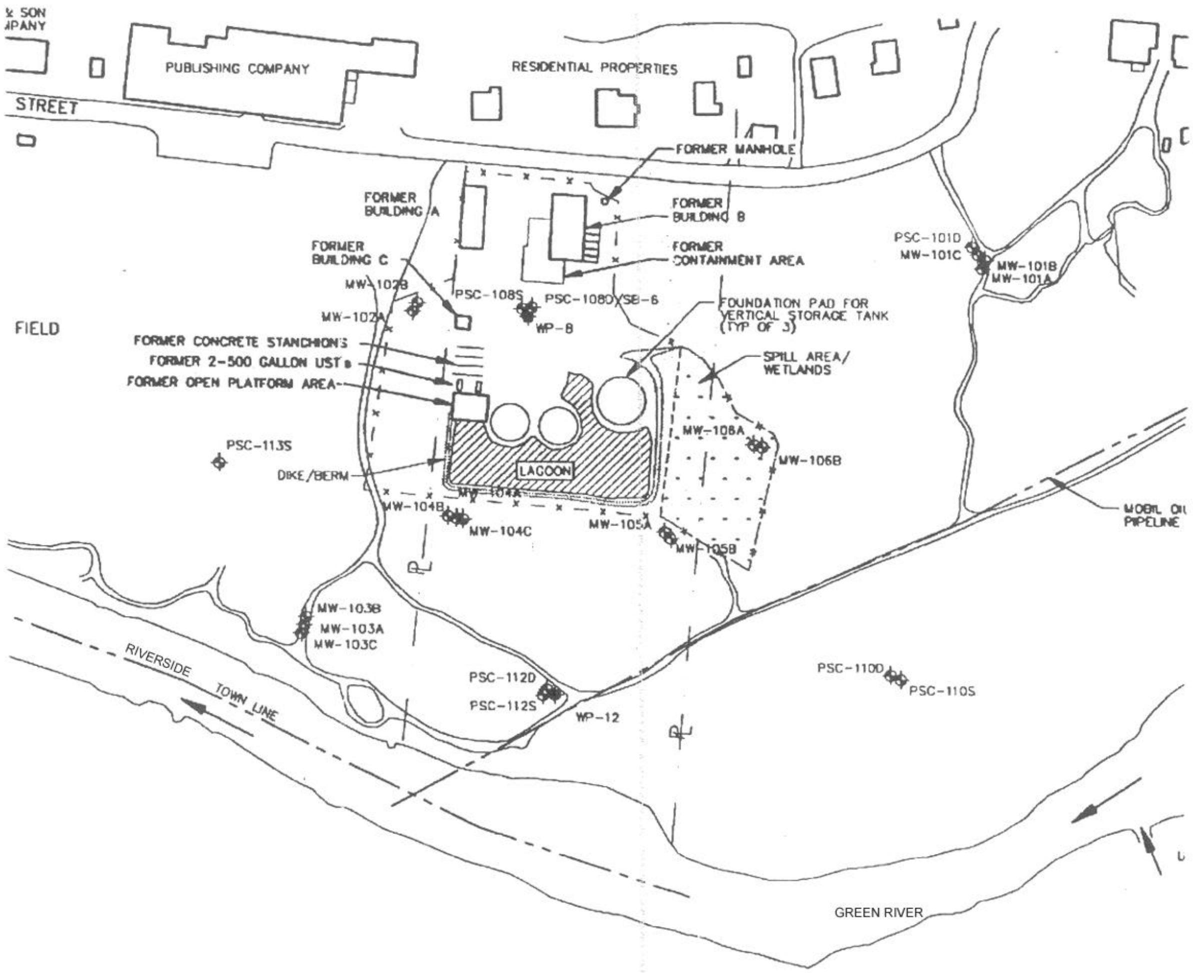
XI. Next Review

The next five-year review for the Acme Superfund Site is required by September 2005, five years from the date of this review.

ATTACHMENTS

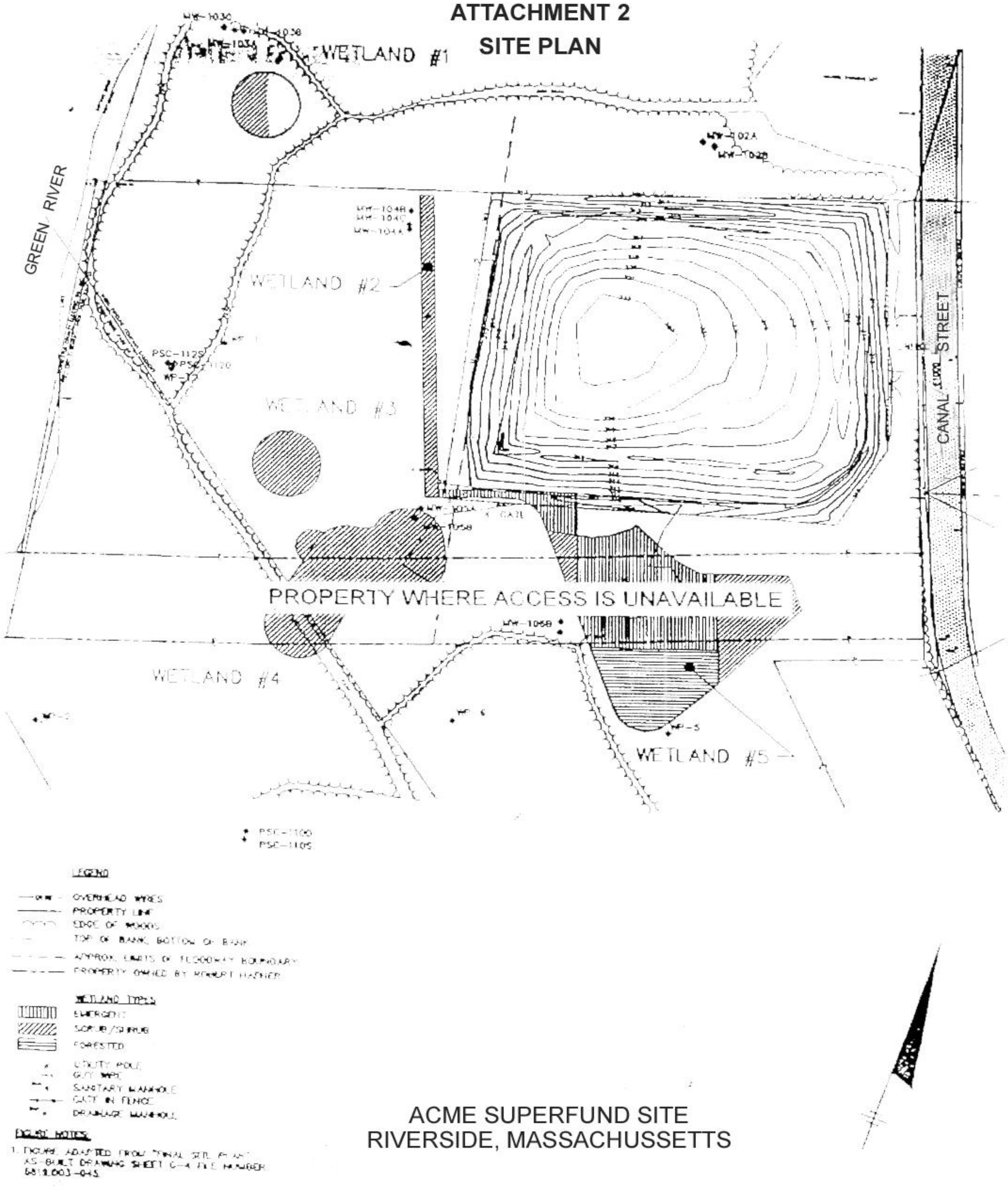
[This page intentionally left blank.]

ATTACHMENT 1
SITE LOCATION MAP



ATTACHMENT 2

SITE PLAN



ACME SUPERFUND SITE
RIVERSIDE, MASSACHUSSETTS

5819005-008
NOVEMBER 1999

SITE PLAN

100 0 100
SCALE IN FEET

ATTACHMENT 3

List of Documents Reviewed

Acme Remedial Design for Stabilization and Containment of Contaminated Soils and Sediments, Riverside, MA, March 5, 1997

Acme Superfund Site Operations & Maintenance Plan, September 18, 1998

Acme Superfund Site PSDs/EPA Settlement Agreement, September 18, 1994

Acme Superfund Site Quarterly Groundwater Monitoring Reports, 1998 and 1999

Acme Superfund Site Record of Decision, September 30, 1992

Explanation of Significant Difference, Remedial Design, Acme Superfund Site, November 26, 1996

Riverside Wetlands Mitigation Plan, Riverside Conservation Commission, Riverside, MA, March 31, 1997

ATTACHMENT 4

Applicable or Relevant and Appropriate Requirements (ARARs)

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Groundwater/ SDWA	Federal - SDWA - Maximum Contaminant Levels (MCLs) (40 CFR Part 141.11-141.16) and non-zero Maximum Contaminant Level Goals (MCLGs)	Relevant and Appropriate	Standards (MCLs) have been adopted as enforceable standards for public drinking water systems: goals (MCLGs) are non-enforceable levels for such systems.	Remediation of contaminated material in soils and sediment will eliminate ongoing discharges of contaminants to groundwater. MCLs and non-zero MCLGs will be attained in groundwater at the point of compliance.

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Surface Water/CWA	Federal - CWA - Ambient Water Quality Criteria (AWQC)- Protection of Freshwater Aquatic Life, Human Health, Fish Consumption	Relevant and Appropriate	AWQC are developed under the Clean Water Act (CWA) as guidelines from which states develop water quality standards. CERCLA §121(d)(2) requires compliance with such guidelines when they are relevant and appropriate. A more stringent AWQC for aquatic life may be found relevant and appropriate rather than an MCL, when protection of aquatic organisms is being considered at a site. Federal AWQC are health-based criteria which have been developed for 95 carcinogenic compounds; these criteria consider exposure to chemicals from drinking water and/or fish consumption. Acute and chronic exposure levels are established.	The selected remedy will attain AWQC in the wetland surface waters and river water after completion of remedial activities.
Groundwater/ CWA	State Department of Environmental Protection (DEP) - Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	State groundwater quality standards have been promulgated for a number of contaminants. When the state levels are more stringent than federal levels, the state levels will be used.	The selected remedy will attain State standards in the groundwater at the point of compliance after completion of remedial activities.

Medium/ Authority	**ARAR**	**Status**	**Requirement Synopsis**	**Action to be taken to Attain ARAR**
Groundwater/ SDWA	State - 310 CMR 22.06 Maximum Contaminant Levels for Inorganic Chemicals in Drinking Water	Relevant and Appropriate	Maximum contaminant levels are established for inorganic chemical contaminants under 310 CMR 22.06. All public water systems must comply with the levels of inorganic contaminants which are listed in Table 1 of 310 CMR 22.06.	The selected remedy will attain State MCLs for inorganics in the groundwater at the point of compliance.
Groundwater/ SDWA	State - 310 CMR 22.07 Maximum Organic Chemical Contaminant Levels in Drinking Water	Relevant and Appropriate	310 CMR 22.07 establishes maximum contaminant levels for selected chlorinated hydrocarbons, pesticides and herbicides.	The selected remedy will attain State MCLs for organic contaminants in the groundwater at the point of compliance.
Air/CAA	Federal - CAA - National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR Part 61)	Applicable	NESHAP standards have been promulgated for two organic compounds present at the site, benzene and vinyl chloride.	Remediation technologies which emit air contaminants regulated under NESHAPs will attain the appropriate standard during operation.
Soil/ Sediments/ RCRA	Federal - Resource Conservation and Recovery Act (RCRA) - Criteria for Classification of Solid Waste Disposal and Practices (40 CFR Part 257)	Relevant and Appropriate	Solid wastes containing PCBs greater than 10 ppm must not be incorporated into the soil (or mixed with surface soil) applied to land used for food chain or pasture crop production.	Any debris, soil, or sediment which contains greater than 10 ppm PCBs will be excavated and stabilized. Institutional controls will prohibit the use of the site for agriculture.

Medium/ Authority	**ARAR**	**Status**	**Requirement Synopsis**	**Action to be taken to Attain ARAR**
Air/CAA	Federal - CAA - National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50)	Applicable	NAAQS define levels of primary and secondary levels for six common air contaminants [sulfur dioxide, particulate matter (PM_{10}), carbon monoxide, ozone, nitrogen dioxide and lead].	The levels established for these six air contaminants will be used as target levels which may not be exceeded by air release from on-site activities.
Surface Water/CWA	State Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharge (314 CMR 12.00)	Applicable	Regulations to ensure proper operation and maintenance of wastewater treatment facilities and sewer systems within the State.	Remedial activities will comply with all provisions of this regulation.
Air/OSHA	Federal - Occupational Health and Safety Act (OSHA) (29 CFR Part 1910.1000 - Air Contaminants)	To be Considered	Acceptable employee exposure levels have been promulgated for an extensive list of materials to control air quality in workplace environments.	Action levels for volatile and semi-volatile air contaminants will be established for implementation during on-site remedial actions. Exposure levels will also be used in the risk assessment to determine overall site risk.

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Groundwater/ CWA	Federal - (Guidance) Groundwater Classification Guidelines	To be Considered	Classifies groundwater by its potential beneficial uses such as special groundwater (Class 1) which is "highly vulnerable to contamination because of the hydrological characteristics of the areas in which it occurs and characterized by either of the following factors: – The groundwater is irreplaceable; no reasonable alternative source of drinking water is available to substantial populations. – The groundwater is ecologically vital; the aquifer provides the base flow for a particularly sensitive ecological system that, if polluted, would destroy a unique habitat. Class 2 groundwater is classified as a current and potential source of drinking water and waters having other beneficial uses. All groundwater which does not fit under Class 1 and which is not heavily saline (total dissolved solids (TDS) > 10,000 mg/l) are considered Class 2 groundwater.	The groundwater aquifer will meet the standards under the SDWA for the appropriate classification of groundwater after completion of remedial activities.

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Sediments/ CWA	Federal - NOAA Technical Memorandum NOS OMA 52	To be Considered	The memorandum identifies reference doses for various contaminants in sediments and their potential biological effects on biota exposed to the contaminants.	Contaminated sediments will be remediated.
Wetlands/ CWA	Federal - CWA Section 404(b)(1); 40 CFR Part 230, 33 CFR Parts 320 - 330	Applicable	Requirements under these codes prohibit the discharge of dredged or fill material into wetlands unless those actions comply with the substantive requirements which are identified under these regulations.	Discharges to wetlands around the site will comply with these requirements.
Wetlands/ CWA	Federal Executive Orders 11990 Protection of Wetlands	Applicable	Under this regulation, Federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	Wetlands protection considerations will be incorporated into the planning and implementation of this selected remedy.

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Floodplains/ RCRA	Federal 40 CFR Part 264.18 Location Standards	Relevant and Appropriate	This regulation identifies geological features that a proposed location for a RCRA hazardous waste treatment and/or disposal facility must avoid. Three specific geological features are identified of which two apply to the site. These features and the significance are: – Floodplain - A facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste unless the owner or operator can demonstrate to the EPA Regional Administrator that he can meet the criteria established under this subpart which exempts him from complying with this requirement.	This site is located within a 100-year floodplain and a portion of the site may be within 200 feet of a fault. On-site remediation activities will comply with the requirements of 40 CFR Parts 264.18(a) and (b).

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Rivers/CWA	Federal - 16 USC 661 et. seq. Fish and Wildlife Coordination Act	Applicable	Mitigative actions must be taken to minimize potential adverse impacts to natural sources such as wetlands. Restoration of damaged natural features are required.	Relevant federal agencies will be contacted to help analyze impacts of the implementation of remedial alternatives on wildlife in wetlands and rivers. Restoration of impacted wetlands will occur once all excavation and stabilization activities are completed.
Wetlands/ CWA	State - Department of Environmental Protection - Wetlands Protection (310 CMR 10.00)	Applicable	These regulations are promulgated under Wetlands Protection Laws, which regulate dredging, filling, altering or polluting inland wetlands. Work within 100 feet of a wetland is regulated under this requirement. The requirement also defines wetlands based on vegetation types and requires that effects on wetlands be mitigated.	The selected remedy will include measures to mitigate and/or replace loss of habitat or hydraulic capacity in accordance with 310 CMR 10.00.

[This page intentionally left blank.]

Appendix G
Methods and Examples for Evaluating Changes in Standards and Toxicity

[This page intentionally left blank.]

Methods and Examples for Evaluating Changes in Standards and Toxicity

This appendix provides a series of flowcharts and examples that you can use to aid in evaluating changes in promulgated standards and chemical toxicity characteristics. The following tables are arranged in two sets, with a generic decision flowchart first. A hypothetical example follows with an example of the flowchart filled in according to the information in the hypothetical example.

Exhibit G-1: Evaluating Changes in Standards

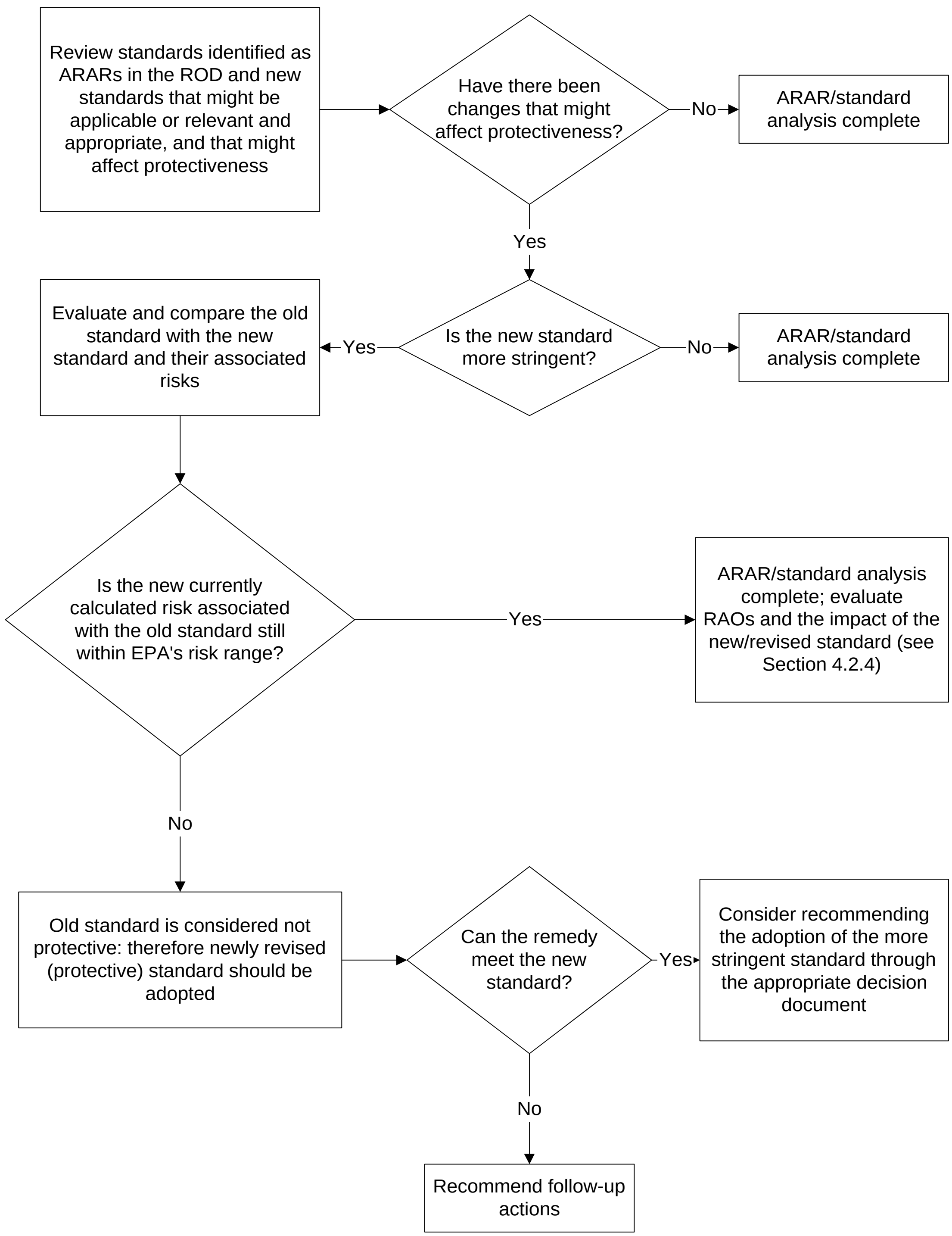


Exhibit G-2: Hypothetical Scenario for a Change in a Standard

During the 1998 Five-Year Review for the Flower Dye site in the State of Franklin, the review team learned that the State drinking water standard for 2,4-Dinitrochickenwire changed from 20 parts per billion (ppb) to 2 ppb. The Record of Decision (ROD), signed in 1988, identified the state standard for 2,4-Dinitrochickenwire as an ARAR and established a cleanup level for 2,4-Dinitrochickenwire at 20 ppb. The ROD also specified that the remedial action objective (RAO) for groundwater is to restore groundwater to drinking water standards. The remedy is to pump-and-treat groundwater using extraction and reinjection wells with air stripping.

In the ARAR/standard analysis (See Exhibit G-1) it was identified that the standard (ARAR) of 20 ppb at the time the ROD was signed had an associated risk of $5x10^{-5}$, which was within EPA's risk range. However, the current risk associated with the same level (20 ppb) now is $5x10^{-4}$ due to changes in the toxicity information that is the basis for the standard. This is generally considered outside of EPA's risk range and therefore, generally considered not protective. As part of the evaluation it was determined that the new standard (2 ppb) has an associated risk of $5x10^{-5}$, which is within EPA's risk range.

In examining the treatment records, monitoring reports, and existing groundwater modeling information, it was determined that the system can treat to 2 ppb, and potentially the remedy can achieve that level in the groundwater. Since the old standard (20 ppb) is no longer considered protective, further actions needed to be taken to ensure that the remedy achieves protectiveness. These actions included the adoption of a protective cleanup level. Therefore, the Five-Year Review report recommended that the new standard (2 ppb) be adopted through an Explanation of Significant Difference. The physical remedy did not have to be modified because it was determined that it could achieve the 2 ppb level. In addition, the RAOs would also be achieved and would not require any modification.

Exhibit G-3: Decision Process for a Hypothetical Change in Standard

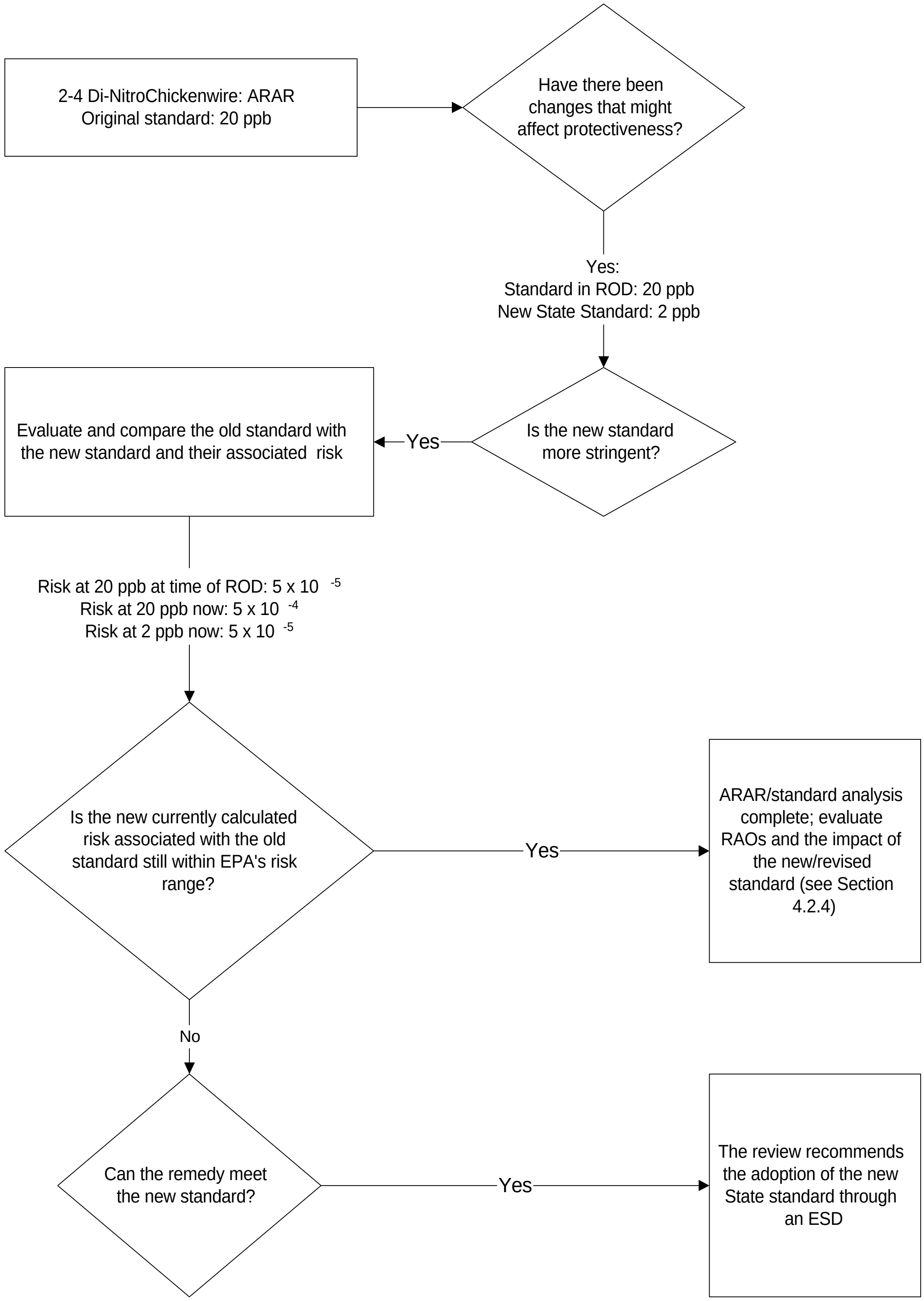


Exhibit G-4: Evaluating Changes in Toxicity and Other Contaminant Characteristics

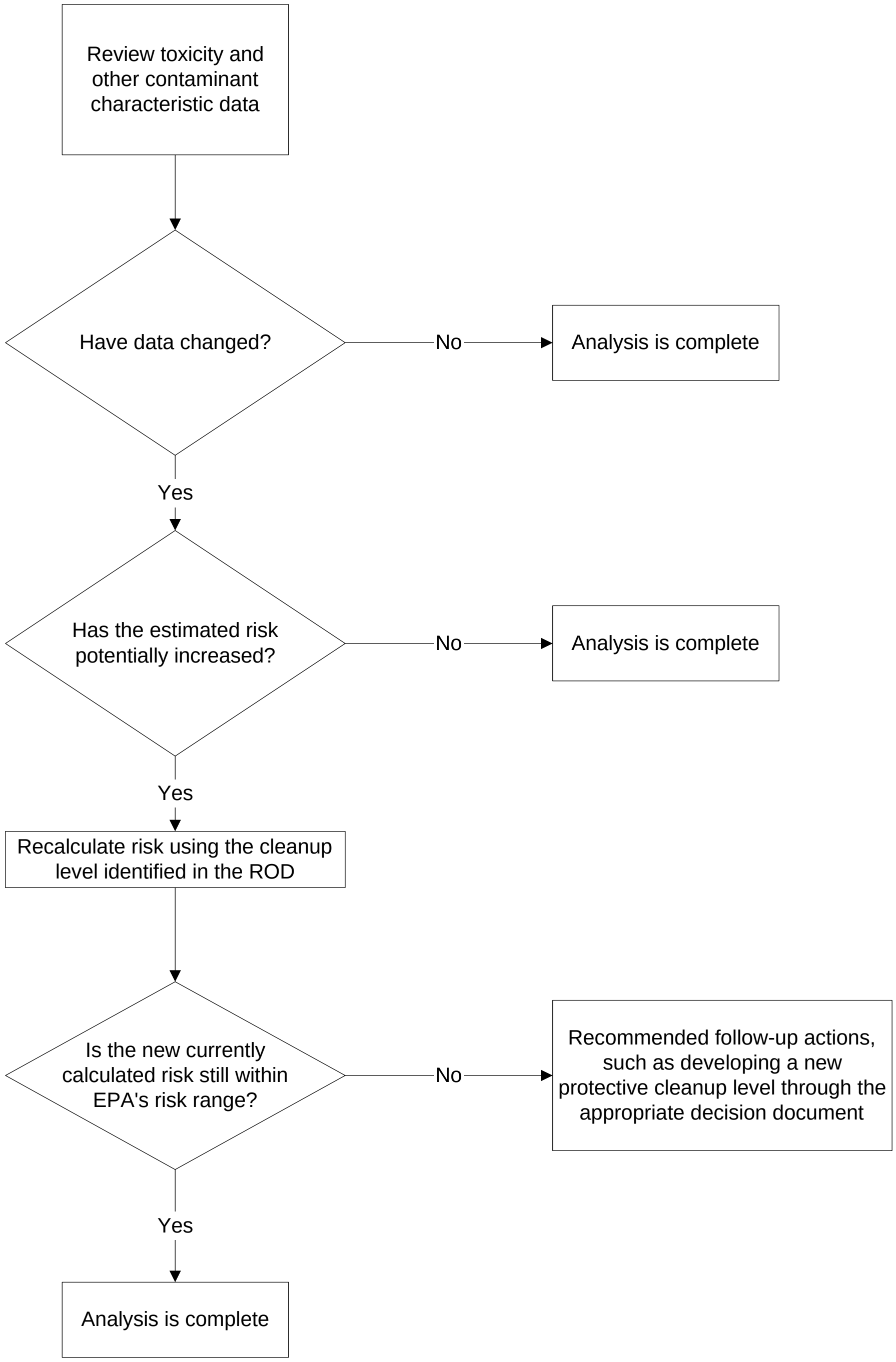


Exhibit G-5: Hypothetical Scenario for a Change in Toxicity

During the 1998 Five-Year Review at the Old Pesticide Disposal site in the State of Franklin, the review team determined that the Cancer Slope Factor (CSF) for the pesticide "Hypochem" had been increased in 1996 from 0.05 $(mg/kg\text{-}day)^{-1}$ to 20.00 $(mg/kg\text{-}day)^{-1}$. Hypochem, among other contaminants, had been found in the water supply well across the street from the Old Pesticide Disposal facility at a concentration of 0.001 mg/L. When the ROD was signed in 1986, this level was associated with a risk level less than one in one million excess cancer cases based on the following equations and site-specific exposure parameters:

$$\text{Average Daily Intake (mg/kg-day)} = (C_{Water} * IR*EF*ED)/(BW*AT) \qquad (1)$$

where:

Parameter			Site Scenario
C_{Water}	=	Contaminant concentration in water (mg/L)	
IR	=	Drinking water intake (ingestion) rate (L/day)	2 L/day
EF	=	Exposure frequency (days/year)	350 days/year
ED	=	Exposure duration (years)	30 years
BW	=	Body weight (kg)	70 kg
AT	=	Average time (days)	25,550 days

$$\text{Target Risk (R) = Average Daily Intake * Cancer Slope Factor} \qquad (2)$$

When equations (1) and (2) are combined, the allowable concentration of Hypochem (C_{Water}) that corresponds to a given risk level "R," can be determined by inserting the site-specific parameters into the following equation:

$$C_{water}\ (mg/L) = (R*BW*AT)/(CSF*IR*EF*ED) \qquad (3)$$

The Old Pesticide Disposal site's original one in one million risk level R = $1x10^{-6}$) was based on the original CSF of 0.05. Thus, equation (3) yielded a health-based screening level for Hypochem of:

$$C_{Water} \text{ for R of } 1x10^{-6} = 0.001704 \text{ mg/L}$$

Since the actual concentration of Hypochem in the water in 1986 was 0.001 mg/L, and thus fell within acceptable limits, there was no need to reduce its levels. (The risk corresponded to 0.6 new cases per million people.) However, using the new CSF of 20.00 to achieve a one in one million risk level R = $1x10^{-6}$), the new health-based screening level for Hypochem becomes:

$$C_{Water} \text{ for R of } 1x10^{-6} = 0.00000426 \text{ mg/L}$$

and using the new CSF of 20.00 to achieve one in a ten thousand risk level R = $1x10^{-4}$), equation (3) yields a C_{Water} value of:

$$C_{Water} \text{ for R of } 1x10^{-4} = 0.000426 \text{ mg/L}$$

Exhibit G-5: Hypothetical Scenario for a Change in Toxicity, cont'd.

The 1986 ROD selected pumping and air stripping of the groundwater to remove solvents also found in the groundwater, and groundwater recharge. Based on sampling records of the recharge water, the stripping unit did not significantly reduce Hypochem concentrations. In fact the current concentration of Hypochem in groundwater is 0.0008 mg/L. Given the new cancer risk factor, the levels of Hypochem are not acceptable because the risk based on this new factor is greater than one in ten thousand (1×10^{-4}).

Based on this result, the Five-Year Review report recommended that a protective cleanup level be developed through the appropriate decision document. In addition, the physical remedy would have to be evaluated to determine whether the current system would be able to reduce the level of Hypochem to protective/acceptable concentrations.

Exhibit G-6: Decision Process for a Hypothetical Change in Toxicity